OPERATIONS IN URBAN ENVIRONMENT 14.2

TECHNOLOGY DEMONSTRATION
FINAL REPORT

EXERCISE VALIANT MARK 14.2
CAMP PENDLETON, CA

DECEMBER 2014

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This report provides information on the Operations in Urban Environments 14.2 event conducted during Exercise Valiant Mark 14.2 in Camp Pendleton, CA. The purpose of the Operations in Urban Environment Collaboration Framework (OUECF) is to explore and demonstrate technologies and capabilities for urban operations in the context of operationally relevant scenarios. The Operations in Urban Environment Collaboration (OUEC) is established between U.S. Pacific Command (PACOM) and, Singapore Ministry of Defence (MINDEF)/Singapore Armed Forces (SAF) as a collaboration track under the ambit of Capability Development Working Group (CDWG). This document provides observations and feedback gathered by the Technology Experimentation Center (TEC) and does not represent the formal position of the U.S. Pacific Command (PACOM) or Department of the Navy.

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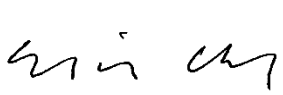

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ACRONYMS

2D	Two Dimensional
3D	Three Dimensional
A*STAR	Agency for Science, Technology and Research
AFAG	Artillery Firing Area Golf
AGL	Altitude Above Ground Level
AO	Area of Operations
AP	Access Point
APL	Applied Physics Lab
AR	Augmented Reality
ASO	Area Security Operations
BLUEFOR	Blue Forces
BN	Battalion
C2	Command and Control
CBT	Combat Town
CDWG	Capability Development Working Group
CO	Commanding Officer
COC	Command Operations Center
COP	Common Operating Picture
CPX	Command Post Exercise
DSLA-Lite	Distributed Sound and Light Array-Lite
EO	Electro-Optical
FMV	Full Motion Video
FOR	Field of Regard
FSTD	Future Systems and Technology Directorate
FTX	Field Training Exercise
GCS	Ground Control Station
GPS	Global Positioning System
HADR	Humanitarian Assistance Disaster Relief
I2R	Institute for Infocomm Research
ISR	Intelligence, Surveillance, and Reconnaissance
IT	Information Technology
JHU-APL	John Hopkins University Applied Physics Lab
JNLW	Joint Non-Lethal Weapons
JNLWD	Joint Non-Lethal Weapons Directorate
JPTD	Joint Plans and Transformation Department
MAR	Marines
MARDIV	Marine Division
MAW	Marine Air Wing
Mech	Mechanized
MEF	Marine Expeditionary Force
MINDEF	Singapore Ministry of Defence
MOUT	Military Operations in Urban Terrain
MU	Main Unit
N/A	Not Applicable

NAVAIR	Naval Air Systems Command
NLW	Non-Lethal Weapons
OPFOR	Operational Forces
OUE	Operations in Urban Environment
OUEC	Operations in Urban Environment Collaboration
OUECF	Operations in an Urban Environment Collaboration Framework
PEVS	Pre-emplaced Electric Vehicle Stopper
PDL	Piedra del Lumbre
PGSS	Persistent Ground Surveillance System
POI	Point of Interest
PU	Power Unit
REGT	Regiment
RF	Radio Frequency
RR/IW	Rapid Reaction/Irregular Warfare
RU	Radio Unit
SAF	Singapore Armed Forces
SIO	Systems Integration Office
SME	Subject Matter Expert
SPAWAR	Space and Naval Warfare Systems Command
ST	Singapore Technologies
TD	Technology Demonstration
TEC	Technology Experimentation Center
TWG	Transformation Working Group
UAV	Unmanned Ariel Vehicle
UGV	Unmanned Ground Vehicle
USPACOM	US Pacific Command
VA	Video Analytics
VCP	Vehicle Control Point
VM	Valiant Mark
USMC	United States Marine Corp

MEASUREMENTS

Ghz	Gigahertz
Mbps	Megabits per second
MHz	Megahertz
W	Watt

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EXECUTIVE SUMMARY

The purpose of the Operations in Urban Environment Collaboration Framework (OUECF) is to explore and demonstrate technologies and capabilities for urban operations in the context of operationally relevant scenarios. The technology collaboration between U.S. Pacific Command (USPACOM) and Singapore Ministry of Defence (MINDEF)/Singapore Armed Forces (SAF) was inaugurated in 2002 as a Transformation Working Group (TWG) under the ambit of the Annual Staff Talk. The Operations in Urban Environment Collaboration (OUEC) was established in 2013 under the sphere of the Capability Development Working Group (CDWG). Previous OUE events focused on testing and demonstrating smart devices as prototypes for tactical Command, Control, Communications, and Computers (C4), improving situational awareness for warfighters in HADR environments, and persistent surveillance in both scripted scenarios and live exercises.

OUE 14.2 was conducted in Piedra del Lumbre (PDL) Combat Town, Camp Pendleton, CA from 5-19 December 2014 in conjunction with Exercise Valiant Mark 14.2. The event consisted of an integrated demonstration of the Persistent Ground Surveillance System (PGSS), 4G LTE communications, video analytics, and the DAVION and PGSS Mobile smart phone applications. The event was divided into 3 main focus areas; the integration of the Singaporean and U.S. technologies, data and feedback collection on the DAVION applications, and data and feedback collection on the PGSS Mobile Client. Users from the Singaporean Guards and Alpha Company, 1st Battalion, 5th Marine Regiment participated in scripted vignettes to gain exposure to the application suites and provide feedback on their utility. Users were also equipped with the ISR integrated smartphones and software during the mechanized assault conducted on 14 December 2014.

On 19 December 2014 a Distinguished Visitors (DV) Day was held to demonstrate the successful integration and utility of the OUE 14.2 technologies. A combined team of Singaporean Guards and U.S. Marines, using the DAVION and PGSS handsets, successfully conducted a live demonstration of some of the features provided by the applications, while utilizing the PGSS network and Video Analytics software to support the scenario. The event was attended by over 60 guests including; Major General Lawrence D. Nicholson, Commanding General, 1st Marine Division, COL Lim Siong Tiong, Head Concept Generation Group, Future Systems and Technology Directorate, COL Tan Cheng Kwee, Commander 7 Singapore Infantry Brigade (7 SIB), Sergeant Major David L. Jobe, Sergeant Major, 1st Marine Division, and other military and civilian visitors of note.

The integration Subject Matter Experts (SME), Singaporean Guards, and U.S. Marine users all provided feedback on the technologies that were inserted in OUE 14.2. Overall the SMEs viewed the integration of the technologies as a success, and through their efforts exhibited the value of collaboration by working together across technologies and organizations to address any issues as they arose. The Singaporean Guards and U.S. Marines provided the technologists with valuable feedback on the functionality, possible improvements, and streamlining of the capabilities of the DAVION applications and PGSS Mobile Client. Overall the users were very happy with the technologies and felt each would be a valuable asset for decision making and situational awareness in almost any environment.

Overall, OUE 14.2 was a successful event for technology insertion, integration, and partner nation S&T collaboration efforts. The data collected from this event will help shape continued technology development for our warfighters and future PACOM S&T engagement efforts.

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INTRODUCTION

Purpose

The purpose of the Operations in Urban Environment Collaboration Framework (OUECF) is to explore and demonstrate technologies and capabilities for urban operations in the context of operationally relevant scenarios. These scenarios articulate common challenges faced by troops operating within the urban environment. The Technology Experimentation Center (TEC) and Future Systems and Technology Directorate (FSTD) worked in concert in capability development by harnessing respective expertise and tapping on respective technology ecosystems to overcome or mitigate the identified operational challenges in the defined scenarios.

Background

The technology collaboration between US Pacific Command (USPACOM) and Singapore Ministry of Defence (MINDEF)/Singapore Armed Forces (SAF) was inaugurated in 2002 as a Transformation Working Group (TWG) under the ambit of the Annual Staff Talk. The Capability Development Working Group (CDWG) replaced TWG in 2007 with the intention to widen the scope of collaboration to include technology development and capability demonstration based on operational challenges common to both USPACOM and the MINDEF/SAF.

The Operations in Urban Environment Collaboration (OUEC) is established between U.S. PACOM, and Singapore MINDEF as a collaboration track under the ambit of CDWG. OUEC will adopt a multi-year spiral approach towards capability development for operations in urban environment. Technologies and/or prototypes will be demonstrated in field environment to seek operational feedback that contributes to enhancing development and facilitating the eventual transition of these technologies.

To kick-start the collaboration, a technology demonstration (TD) that successfully demonstrated the use of smart devices (ipads and iphones) as prototype tactical C4 systems was conducted during the Area Security Operations phase of Exercise Valiant Mark (VM) 11. Going ahead, the TEC and FSTD, built on this initial success and continued to leverage various plausible platforms to enhance and further develop capabilities. The 2012 Operations in Urban Environments (OUE) TD focused on improving situational awareness for warfighters in Humanitarian Assistance Disaster Relief (HADR) environments and identifying opportunities to improve interoperability between the U.S. and Singaporean militaries. From January 13-25 an OUE TD was conducted during exercise VM14.1 venue in western Singapore. U.S. and Singapore technologies together demonstrated a persistent surveillance capability in both scripted scenarios and during observation of VM 14.1 forces. As the final phase, OUE 14.2, USPACOM and MINDEF conducted an integrated demonstration of the Persistent Ground Surveillance System (PGSS), 4G LTE communications, video analytics, and smart phone technologies.

Valiant Mark 14.2 Objectives

Valiant Mark is an annual bilateral training exercise conducted between Singapore Armed Forces (SAF) and I Marine Expeditionary Force (MEF). Historically VM has been conducted in a

variety of methods ranging from a Battalion (BN) level Command Post Exercise (CPX) conducted in Singapore to a Commanding Officer (CO) level Field Training Exercise (FTX) conducted in the US and Singapore. Beginning in 2014, the VM series of exercises will be focused solely on full spectrum, combined arms training. The exercises will run on a two year cycle. The first event of 2014 (VM 14.1) was conducted in Singapore with company level training focused on individual and unit live fire, heliborne operations and Military Operations in Urban Terrain (MOUT). The second year will was conducted in the US with BN-Regiment (REGT) level, high end, combined arms live fire training. VM 14.2 was scheduled to take place in December 2014 in conjunction with exercise Steel Knight, a division level combined arms exercise in 29 Palms and Camp Pendleton.

VM 14.2 Exercise Objectives:

- Develop and enhance full spectrum combined arms core competencies
- Conduct company level live fire and maneuver
- Conduct MOUT
- Conduct mechanized Ops
- Conduct sniper training
- Conduct engineer training
- Conduct 120mm mortar training
- Conduct SAF BDE/REGT staff augmentation/planning
- Conduct SAF aviation observation (in preparation for VM 2016)
- Develop and enhance U.S. Marine Corp (USMC)/SAF command and control in a combined environment
- Enhance USMC-SAF interoperability
- Improve USMC-SAF mil-to-mil relationship

General OUECF Objectives

This section outlines the overall OUECF objectives. These objectives have three key focus areas: Surveillance, C4, and Response.

Surveillance

- Unmanned Ariel Vehicle (UAV) to capture imaging and video streams by flying between buildings, and perching-and-staring at critical junctions or areas for persistent surveillance
- Smartphones to capture street level images and video carried by the operators to realize the concept of 'soldier sensor', supported by Intelligence, Surveillance, and Reconnaissance (ISR) unmanned ground vehicles (UGV)
- Video analytics and tracking algorithms to provide estimation of crowd size, allow recognition of potentially aggressive behavior, and identify possible presence of instigators, including tracking of personnel or objects of interest across non-overlapping video coverage
- Algorithms to generate three-dimensional (3D) buildings and terrain automatically using the images and video streams collected by the UAV, UGVs, and smartphones to provide the most up-to-date 3D terrain and building map of the area of operation, which may have changed due to the effects of natural disasters or collateral damages

C4

- Modular mobile Command and Control (C2) and smart devices serve as tactical C4 systems to facilitate responsive dissemination, coordination, and execution in the urban environment
- Fusion algorithm to fuse structured reports from ground survey teams, other external data sources, and the fused information correlated and tagged to the respective geo-locations within the 3D terrain map
- Sense making algorithms to help identify patterns and detect anomalies within the fused data sources, including identifying important social-cultural relationships within the distressed populace, and helping to predict potential outbreaks of epidemics or social unrest
- HADR C2 system provides a private communication network to link up commercial smartphones and military radios

Response

- Calibrated crowd simulation models calibrated to represent the local populace to help planners and commanders study what-if scenarios and develop contingency plans for missions that involve the local populace
- Dynamic resource allocation decision support engines to help match resources to the demands gathered from the operators on the ground. The dynamism arises from the streaming of relief stockpiles into the area of operations and the uncertainty in terms of demands put forth by displaced personnel
- Various non-lethal means (for example, Area Denial System, Long-range Acoustic Device) to manage the civilian populace, which may potentially turn violent

Operational Problem

The purpose of OUECF is to explore and demonstrate technologies and capabilities for urban operations in the context of HADR scenarios. The urban environment hosts a number of operational challenges. These challenges include, but are not limited to the following:

- Diminished line of sight
  - Physical line of sight
  - Communications line of sight
- "Dirty battlefield"
  - Urban environments populated with non-combatants
- Limited situational awareness at the tactical level
  - Decreased reaction time at the individual and small unit level
  - Limited integration of ISR assets into a common operational picture

OUE 14.2 mainly focused on addressing the limited situational awareness at the tactical level problem by exploring the use of integrated ISR assets and applications designed to enhance the warfighters' situational awareness during operations.

OUE 14.2 TD Objectives

To support continued collaboration, the TEC, FSTD, and MINDEF developed the following 3 main objectives for the OUE 14.2 TD:

- **Objective 1: Demonstrate interoperability between U.S. and Singapore systems and technologies**
- **Objective 2: Cross-sharing of U.S. and Singapore capability development efforts**
- **Objective 3: Address a common operational problem shared by the SAF and USPACOM forces, conducting operations in urban environments**

Additionally the following secondary objectives were developed to help focus efforts and identify practical applications for OUE operations:

- Support continued collaboration between the U.S. and Singapore
- Collect feedback on OUE TD participating technologies
- Collect feedback on hands-on training conducted as part of the buildup to event execution
- Illicit suggestions for future applications and technologies to support HADR operations
- Identify suggested improvements to existing applications and capabilities

Technology Description

The following section provides a brief description of each of the technologies that participated in VM14.2. The Joint Non-Lethal Weapons (JNLW) technologies were demonstrated during the event, but were not part of the overall integration or data collection effort.

Persistent Ground Surveillance System (PGSS) Technologies

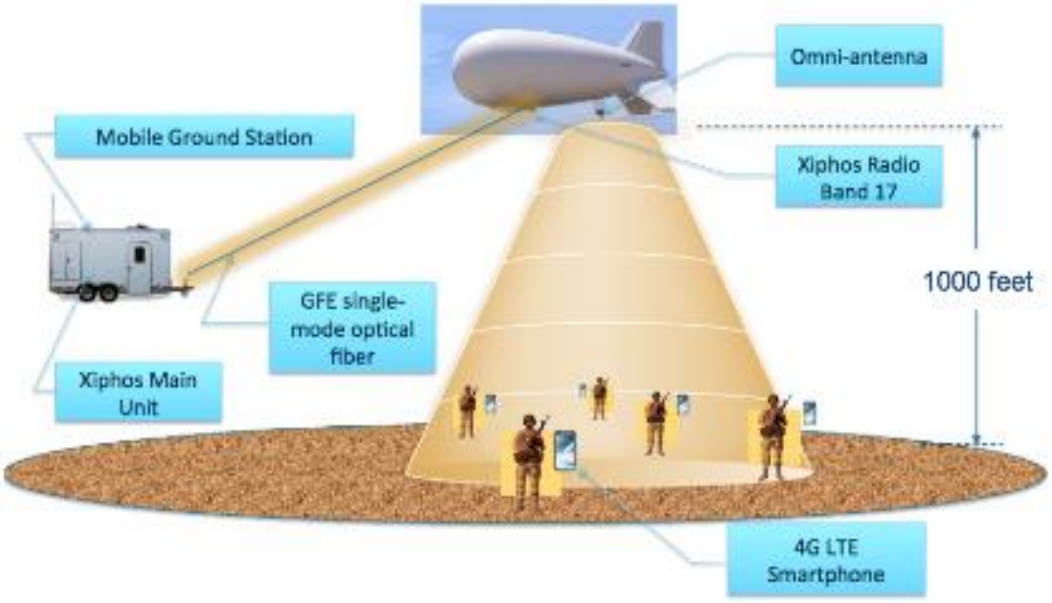
Persistent Ground Surveillance System (PGSS) is a lighter-than-air, medium-sized tethered aerostat that provides an ISR capability for temporary and semi-permanent operating locations capable of providing persistent, integrated, networked and multi-sensor information collection for long periods of time from various altitudes to maximize line-of-site and field-of-regard.

PGSS Mobile Client

The PGSS Mobile Client is an extension of the Ageon ISR software, developed specifically for a mobile device to provide portable real-time situational awareness to the operator. The Mobile App leverages the PGSS ground control station's (GCS) network connection in order to access live full motion video (FMV) from dedicated mission sensors. The capability also provides blue force tracking, geotagging, chat, voice comms, and the ability for the user to slew mission sensors.

PGSS 4G LTE System

The 4G LTE system is divided into two main subsystems. A radio unit (RU) and associated antennas, cabling, and mounting hardware integrated onto the PGSS aerostat. And the main unit (MU), power unit (PU), and Global Positioning System (GPS) antenna, located at the ground station. Communication between the RU and the MU is provided over a single-mode optical fiber that connects the PGSS to the ground station. The system has been licensed for 15 concurrent users and should support an aggregate throughput of 37 Mbps download and 25 Mbps upload for a 10 MHz bandwidth configuration. For reduced bandwidth configurations, the aggregate throughput is reduced proportional to the reduction in bandwidth.



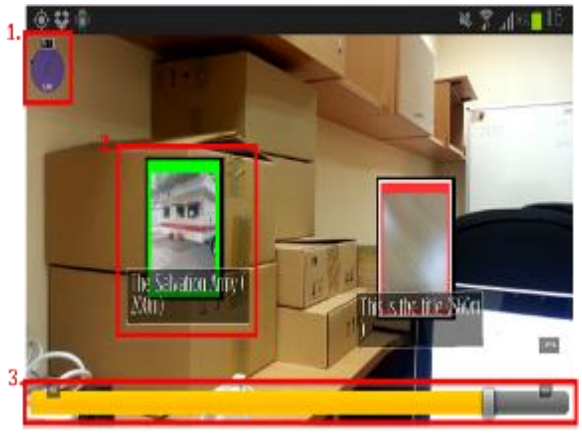
The RU transmits 60 W output power. The coverage provided by the system is dependent upon the deployed height of the aerostat. At a height of 1000 feet AGL and relatively flat terrain, a radius of coverage of approximately 10 miles is predicted. The RU will operate in LTE Band 17 with an uplink center frequency of 710 MHz and a downlink center frequency of 740 MHz. Both the uplink and downlink transmissions will occupy a nominal either 5 MHz or 10 MHz bandwidth depending on the network configuration under test.

Video Analytics

Smart Video Analytics (VA)
The Smart Video Analytics software developed by A*STAR Institute for Infocomm Research (I2R) uses electro-optical (EO), visible light camera video to detect and track people and identify suspicious activities. Video feeds from various sources can be used as a master camera that detects and tracks people. The detections are tracked geographically by the system and displayed on a map. The location is used to cross cue a slave camera. The slave camera imagery is used to identify suspicious characteristics and actions.

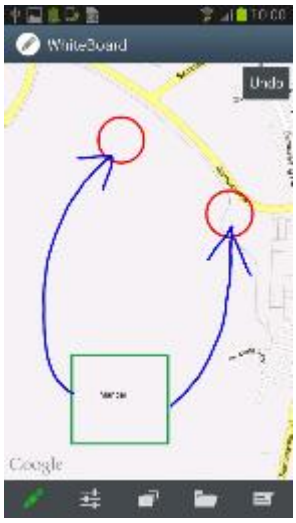
DAVION Applications

DAVION Map
Users are able to track each other's movement on the map once they logon to the system. Each user's location will be represented by a blue drop-pin displayed on the 2D map. When the users move, the blue force tracking module will reflect their updated locations on the two dimensional (2D) map every 30 sec. A blue circle represents the location of the current smart phone while a red drop-pin represents enemy force. Green drop-pin represents general report and purple drop-pin represents point of interest (POI). The image to the right shows the current user's location, 2 blue forces, 5 red forces and 1 general report.



DAVION Augmented Reality (AR)
The AR view superimposes information such as locations of blue forces and reports over live video feeds. By using the user's facing-direction, we are able to superimpose information of blue forces, red forces, POI on the video feedback that is shown in Fig.2. A small radar can be found at the top left position as highlighted in box 1. This displays the location of all blue forces, red forces and POI surrounding the mobile device of interest. It allows users to quickly see how many blue forces, red forces and POI are in the plan field of view.

DAVION Group Chat
This function is similar to the popular group chat app, WhatsApp. The apps features include one-to-one messaging, one-to-many messaging, many-to-many messaging (group chat), and file sharing. All information will be transmitted using a backend server.



DAVION WhiteBoarding
White boarding allows users to draw free hand on 2D street map. Multiple users will be able to share their drawings in near real time. In lab conditions, we are able to achieve <4 sec lag for 10 users. The full set of features includes:

i. Layer
ii. Shapes & colours
iii. Archiving
iv. Undo

Joint Non-Lethal Weapons (JNLW)

Pre-emplaced Electric Vehicle Stopper (PEVS) PEVS is designed to stop and disable vehicles. PEVS has the potential to support multiple missions including: force protection and vehicle checkpoint operations. This technology is designed to slow or arrest vehicle momentum or to be used in concert with a barrier or entanglement system to stop vehicles. The system is a pre-emplaced, non-intrusive device that provides an electrical pulse through deployed contacts, to shut down power train electrical circuits or components.

Distributed Sound and Light Array (DSLA) – Lite Distributed Sound and Light Array (DSLA) is a non-lethal acoustical and optical device that provides hailing and warning capabilities. Still in the developmental stage, the DSLA uses the combined effects of two integrated sensory stimulators: a distributed, high-output, phased acoustic array and a distributed, high-output, coherent (laser)/non-coherent (bright white light) optical array. As part of the DSLA's hailing and warning capabilities, the DSLA's light array attracts the attention of the target, while the sound array conveys specific instructions to the target.

EXECUTION

Locations

Camp Pendleton Area of Operations (AO)

Marine Corps Base Camp Pendleton (Figure 1), the Corps' largest West Coast expeditionary training facility, encompasses more than 125,000 acres of Southern California terrain. Located approximately 38 miles from downtown San Diego in North County and 82 miles south of Los Angeles, Camp Pendleton has been the largest employer in North San Diego County for more than 60 years. Camp Pendleton is one of the Department of Defense's busiest installations and offers a broad spectrum of training facilities for many active and reserve Marine, Army and Navy units, as well as national, state and local agencies.

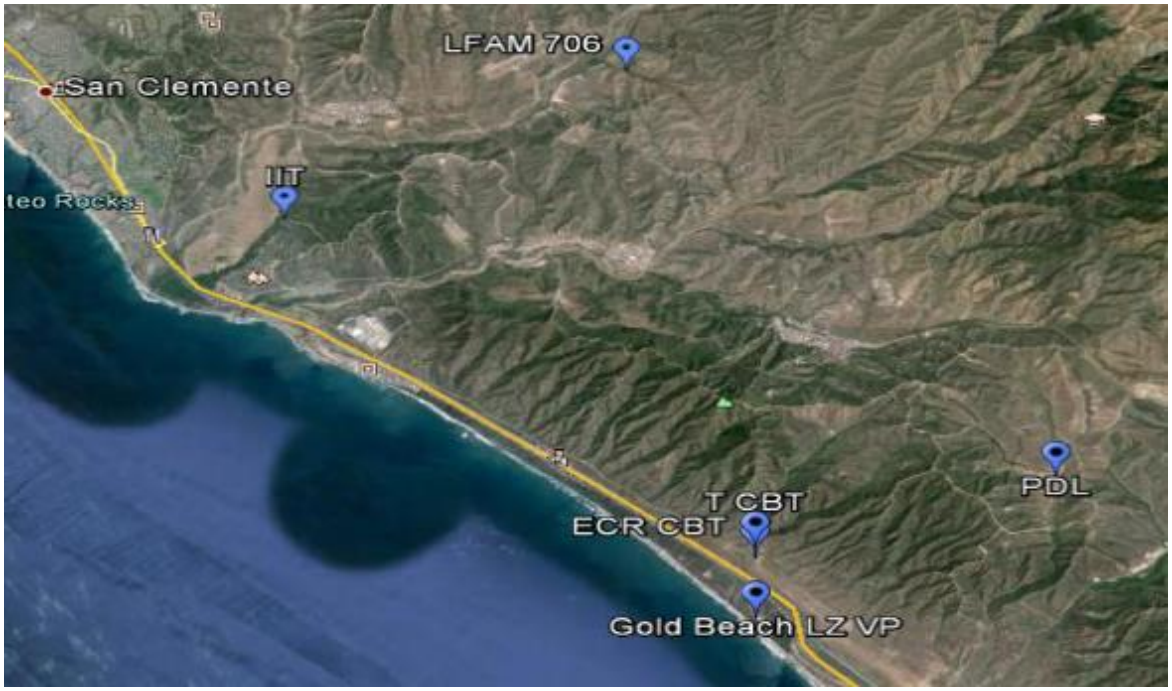


Figure 1: Camp Pendleton AO

Piedra del Lumbre (PDL) Combat Town (CBT)

PDL Combat Town (Figure 2) is composed of 68 containers making 23 simulated buildings. The facility allows for non-live fire training in a realistic industrial-looking environment that includes guard houses, maintenance shacks, water tower, steam pipes, vehicle gates, pedestrian gates, pry doors, solar-powered street lights, weapons cache, and athletic field. PDL Canyon Road runs north-south along the east side of PDL Combat Town. Artillery Firing Area Golf (AFAG) borders the west side of PDL Combat Town and was used in the Joint Non-Lethal Weapons Directorate (JNLWD) scenario for the vehicle approach to the vehicle checkpoint located on the west side of PDL CBT and non-lethal weapons effects/surface danger zones. The athletic field bleachers will was used for the Tech Demo visitors and static display area (Figure 3).

Figure 2: PDL Combat Town

Figure 3: PDL Combat Town Demonstration Areas

Participants

The OUE 14.2 event participants (Figure 4) included military, government organizations, and private technology companies. The OUE 14.2 coordination and interface with technology providers was performed by the TEC working with a team of three MINDEF/SAF organizations.

Figure 4: OUE 14.2 Team with Singaporean Guard Users

Technology Experimentation Center (TEC)

The TEC, in support of USPACOM, coordinated with all OUE participants, VM 14.2 U.S. forces, and U.S. Tech Demo observers; arranged logistics support; helped developed OUE scenarios; and documented events and participant feedback through briefings and this report. The TEC is a U.S. Government consortium of technology and operational community subject matter experts working together to enable the warfighter by conducting technology demonstrations, experiments, and assessments in relevant operational venues and environments.

Singapore Ministry of Defence (MINDEF)/Singapore Armed Forces (SAF) Team

The MINDEF/SAF team consisted of military and civilian personnel from the Future Systems and Technology Directorate (FSTD), Joint Plans and Transformation Department (JPTD), and Systems Integration Office (SIO). FSTD was the coordination lead for the MINDEF/SAF team, coordinating among MINDEF/SAF and with all Singapore technology providers. JPTD, as a signatory on the OUE Collaboration Framework, ensured that OUE activities aligned with

CDWG intent. SIO provided SAF warfighter input to OUE scripted scenario development and execution.

Naval Air Systems Command (NAVAIR) Rapid Reaction/Irregular Warfare (RR/IW)
NAVAIR is a U.S. technology provider, deploying the Persistent Ground Surveillance System, EO/IR sensors, and common operating picture software. NAVAIR provided an outdoor wireless mesh communications system that provided local Wi-Fi across the area of operations for OUE technologies. NAVAIR Subject Matter Experts (SMEs) provided training to users, and SME feedback on the integration process.

Agency for Science, Technology and Research (A*STAR) Institute for Infocomm Research Institute for Infocomm Research (I2R)
A*STAR I2R provided video analytics software and video surveillance cameras. A*STAR worked with the MINDEF/SAF and PGSS teams to install the video cameras in and around PDL. A*STAR incorporated video feeds from surveillance cameras and the NAVAIR system. A*STAR provided engineers/scientists to perform various tasks including camera installation, network configuration and integration, software tuning, scripted scenario coordination, and SME feedback.

Singapore Technologies (ST) Electronics (Info-Software Systems)
ST Electronics provided engineers/scientists to incorporate video feeds from NAVAIR and A*STAR systems into handheld devices. ST provided hands-on training for OUE Users and Tech Demo observers.

Alpha Company, 1st Battalion, 5th Marine Regiment, 1st Marine Division
Alpha Company provided 10 users for training and use of the handsets during the mechanized assault, and 5 users who remained to execute vignettes and participate in DV Day (Figure 5). Headquartered at Marine Corps Base Camp Pendleton, Calif., 1st Marine Division is a multi-role, expeditionary ground combat force. The Division is employed as the ground combat element of I Marine Expeditionary Force or may provide task-organized forces for assault operations and such operations as may be directed. The 1st Marine Division provides amphibious forcible entry capability to the naval expeditionary force and conducts subsequent land operations in any environment. The 5th Marine Regiment is an infantry regiment of the United States Marine Corps. It is the most highly decorated regiment in the Marine Corps and falls under the command of the 1st Marine Division and the I MEF.

Figure 5: U.S. Marine Users

Singaporean Guards

The Singaporean Guard provided 5 users that participated in training, vignettes, and the DV Day demonstration (Figure 6). In the Singapore Armed Forces, the Guards are an elite infantry formation specializing in rapid deployment. Guards are known as elite heliborne troopers. They are well trained in heliborne operations and specialist combat skills that give them an added combat edge. They are proficient in heli-rappelling, heli-landing, and other specialized skills that allow them to carry out heliborne operations in various terrain, day and night. Because of their special training they have earned respect and status in the Singapore Armed Forces. The formation traces its roots back to the 7th Singapore Infantry Brigade and has been actively involved in several National and Army Day events since the establishment of the modern Guards unit.

Figure 6: Singaporean Guard Users

Data Sources

The TEC OUE team utilized the following data sources to collect data and feedback on the OUE14.2 TD event:

Questionnaires/Surveys
OUE user groups completed questionnaires/surveys designed primarily to gather feedback on the OUE technologies and the integration process. Questions used a six-point rating scale ranging from Completely Disagree to Completely Agree and provided space for comments to allow users to explain their ratings, or to comment further. In addition, a Not Applicable (N/A) choice was available to those users who felt a particular question did not apply to them. A separate page of the questionnaire was devoted to demographic information.

Interviews
When appropriate, OUE user group participants were asked to participate in interviews with data collectors on a noninterference basis. Questions were designed to collect user feedback on the OUE technologies in relations to relevant measures.

Event Logs
Event Logs were used to capture subjective and objective data during the OUE events. The data captured included performance data, timeline, user impressions, SME observations, and the data collectors' independent view.

Photographs
Data collectors captured photographs to support the TD. Data collectors ensured photographs remain unclassified and are approved for release by the appropriate agencies.

OUE Schedule

Table 1 provides a summary of the OUE 1.2 TD events.

Table 1: OUE 14.2 TD Events

Date	Location	Event
12/5/14	Oceanside, CA	-Receive PGST equipment
12/6/14	Oceanside and PDL	-Occupy PDL -PGSS Setup
12/7/14	Oceanside and PDL	-PGSS Setup/VA, DAVION Integration
12/8/14	Oceanside and PDL	-PGSS Setup/VA, DAVION Integration
12/9/14	Oceanside and PDL	-PGSS Setup/VA, DAVION Integration
12/10/14	PDL	-Determine and mark Vignette routes -PGSS Setup/VA, DAVION Integration -Data Collection and Testing -NLW Setup and Prep
12/11/14	PDL	-Singaporean Guard Training and Vignettes -User Surveys
12/12/14	PDL	Operations canceled due to inclement weather
12/13/14	PDL	-NLW Setup and Prep
12/14/14	PDL	-OPFOR Training and Vignettes -User Surveys

		-No NLW activities
12/15/14	PDL	-Mech Assault -NLW Training
12/16/14	PDL	-PGSS Setup/VA, DAVION Integration -Range testing of 4G LTE
12/17/14	PDL	Operations canceled due to inclement weather
12/18/14	PDL	-DV Day Rehearsal -NLW Scenarios
12/19/14	PDL	-DV Day -User Survey Reviews -Equipment teardown
12/20/14	PDL	-Depart PDL -PGSS Equipment pickup

Data Collection Approach

The TEC conducted OUE 14.2 during VM 14.2. VM 14.2 provided a bilateral exercise venue for collecting feedback on and demonstrating the technologies participating in OUE 14.2. The majority of the information gathered to support the OUE 14.2 event was objective data gathered from event and daily logs, and subjective data from the DAVION and PGSS Mobile Client users and Subject Matter Expert (SME) observations. User feedback and SME observations were collected via questionnaires and interviews.

The data collection process consisted of three main focus areas; integration DAVION applications feedback, and PGSS Mobile Client feedback. As part of OUE 14.2 U.S. and Singaporean technologies were integrated to demonstrate the combined capabilities of the technologies. The integration also provided a learning environment that fostered information sharing and collaboration. The main technology integration period, time set aside specifically to integrate the technologies before user training, was scheduled for 7-12 December. Due to shifts in user availability, users arrived early and shortened the integration period to 7-10 December. However, integration continued in a limited form during training, as to not negatively affect the users, and in the days following to tweak the integration methods for maximum performance. As part of the integration process limited range testing was conducted on the PGSS 4G LTE capability. To document the entire integration process a third party IT SME observed and documented the process to include setup, problems, resolutions, and success.

The two other focus areas of OUE 14.2 included collecting feedback on the DAVION applications and PGSS Mobile Client. As part of the event, the TEC team organized user groups from the Singaporean Guard and the U.S. Marines. Users from each group were sorted into DAVION or PGSS users and participated in training and vignettes designed to familiarize them with the applications. The Singaporean and U.S. teams each separately completed a full day of training, one day of rehearsal, and a half day dedicated to a live demonstration during the OUE 1.4 DV Day. Users were also provide ISR equipped smartphones for use during the mechanized assault conducted on 15 December 2014. Throughout the event users were provided surveys to collect their feedback on the technologies.

General Data Collection Plan

Tables 2 and 3 describe the data collection plan for the OUE VM14.2 TD event. Data was collected using various methods outlined in the data sources section of this document. The primary data collection team consisted of the Lead Analyst, a MINDEF/SAF team representative, and the Information Technology (IT) SME.

Table 2: Technology Integration (Week 1)

Event	Data Collectors	Data Collected
PGSS Setup/PGSS, VA, DAVION Integration Data Collection and Testing	-IT SME (Observations, diagrams, and event logs) -Lead Analyst (Support IT SME as needed, Surveys and Demographics) -PGSS, VA, DAVION teams (event logs)	• Technical and networking data on the setup of the PGSS, VA, DAVION systems • Integration observations • Event logs for any integration, interoperability, or reliability issues • Event logs for LTE range testing • SME Surveys • SME Demographic Forms

Table 3: Application Training and Vignettes, Cont. Integration, TD (Week 2)

Event	Data Collectors	Data Collected
Singaporean Guard Training and Vignettes	-Lead Analyst (Training and Vignettes, event logs) IT SME (Observations, diagrams, and event logs) -PGSS, VA, DAVION teams (event logs)	• Guard User Surveys • Guard Demographic Forms (during training) • Observations on training, users, and events • Technical, networking, and integration of technologies. • Event logs for issues and/or range testing
U.S. Marine Training and Vignettes	-Lead Analyst (Training and Vignettes, event logs) IT SME (Observations, diagrams, and event logs) -PGSS, VA, DAVION teams (event logs)	• Marine User Surveys • Marine Demographic Forms (during training) • Observations on training, users, and events • Technical, networking, and integration of technologies. • Event logs for issues and/or range testing
Mech Assult Vignette, Training,	-Lead Analyst (Training and Vignettes, event logs) IT SME (Observations, diagrams, and event logs) -PGSS, VA, DAVION teams (event logs)	• Observations on training, users, and events • Technical, networking, and integration of technologies. • Event logs for issues and/or range testing
DV Day Internal Rehearsal	-Lead Analyst (DV Day details) IT SME (Observations, diagrams, and event logs) -PGSS, VA, DAVION teams (event logs)	• DV Day schedule and layout • Technical, networking, and integration of technologies. • Event logs for issue and/or range testing
DV Day Rehearsal	-Lead Analyst (DV Day details and observations) IT SME (Observations, diagrams, and event logs) -PGSS, VA, DAVION teams (event logs)	• Observations on training, users, and events • DV Day schedule and layout • Technical, networking, and integration of technologies. • Event logs for issues and/or range testing
DV Day	-Lead Analyst (DV Day details and observations) IT SME (Observations, diagrams, and event logs) -PGSS, VA, DAVION teams (event logs)	• Observations on training, users, and events • DV Day schedule and layout • Technical, networking, and integration of technologies. • Event logs for issues and/or range testing

Scope and Limitations

Due to the nature of a demonstration/exercise environment, certain limitations impacted the demonstration and data collection. Participants attempted to use all efforts and means to mitigate the impact of limitations on the event. Table 4 provides a summary of the OUE 14.2 limitations.

Table 4: OUE Limitations

LIMITATION	IMPACT	MITIGATION
The DAVION and PGSS Apps are still in development.	Both suites of applications had problems with updating information in real time. System crashes were noted by users and data collectors.	For survey purposes, users were informed of the developmental nature of the technology. For development purposes, event logs were collected on reliability issues throughout the event.
The OUE event is scenario based.	Due to time and network constraints, scenarios had to be conducted within a limited area. This impacted the realism of some of the patrol scenarios, but users were still able to utilize the applications as needed for exposure and data collection.	Scenarios were developed to simulate realistic/believable events to ensure users were able to provide desired feedback. Data collectors tailored scenarios as needed to help support the data collection process.
Users had a limited amount of time to use the Apps and form opinions.	The OUE team was able to conduct one full day of training with the Singaporean Guards, and one with the Marines. Each group also participated in a rehearsal day and the DV Day. One Marine was replaced and had to receive training on the rehearsal day but he picked up the applications quickly and became our PGSS HQ rep during the DV Day demonstration.	The OUE team worked to try to get additional time with users. The OUE team developed vignettes to help expose the users to each application within a relevant scenario. The OUE team provided for flexibility in the schedule to help support opportunities for additional time with users.
OUE is operated within a military exercise which could impact scheduled events	The training for the Singaporean Guards occurred 2 days early. This strongly impacted the integration timeline and resulted in some features of the PGSS, DAVION, and VA not being available for use during training	The OUE team built flexibility into the movement schedule to accommodate possible shifts in exercise events
Vignettes were conducted within a limited range, real world operations would likely involve larger distances	The range of the WiFi limited the area for vignette operations. Users were still able to gain exposure to the applications. This was ultimately a positive as our time was limited and we could not afford using valuable training time for users to traverse longer distances.	Detailed integration, networking, and rage data was collected during the event to help support future data extrapolation for various ranges
Potential for RF interference on WiFi and LTE	No RF interference was reported, but there were issues with the WiFi dropping during training	The OUE team will work with the base spectrum team and the technologists to try to limit interference

Vehicle Control Point (VCP) Monitoring and Response Scenarios

The following scenarios were developed to explore the capabilities provided by the integration of the PGSS, VA, and DAVION technologies. The overall focus of the vignettes was to highlight the usage of the VA technology, DAVION applications, and PGSS Mobile Client for improved situational awareness and incident management. The technologists and IT SMEs recommended that the scenarios be conducted using the Wi-Fi capability. As a result all vignettes were run using the WiFi capability.

Vignette 1: Monitoring of activity in vicinity

The purpose of Vignette 1 was to provide a training scenario where users could apply the applications offered by the PGSS Mobile Client or DAVION to incident management missions (Figure 7). The PGSS and VA imagery was used to determine the normal Blue Forces (BLUEFOR)/OPFOR route. Once a deviation was detected an alarm was sent to users. The applications then helped facilitate real-time situational awareness to support users with response efforts. This vignette was conducted outside (open road) of the PDL Combat town (urban). Originally the OUE team planned to also run this vignette inside of the combat town, but due to time constraints, and camera issues the focus was shifted to only the open road version. The suspicious items used in this vignette were located outside of the camera view. Tables 5 and 6 provide vignette 1 detailed action plans for PGSS and DAVION.

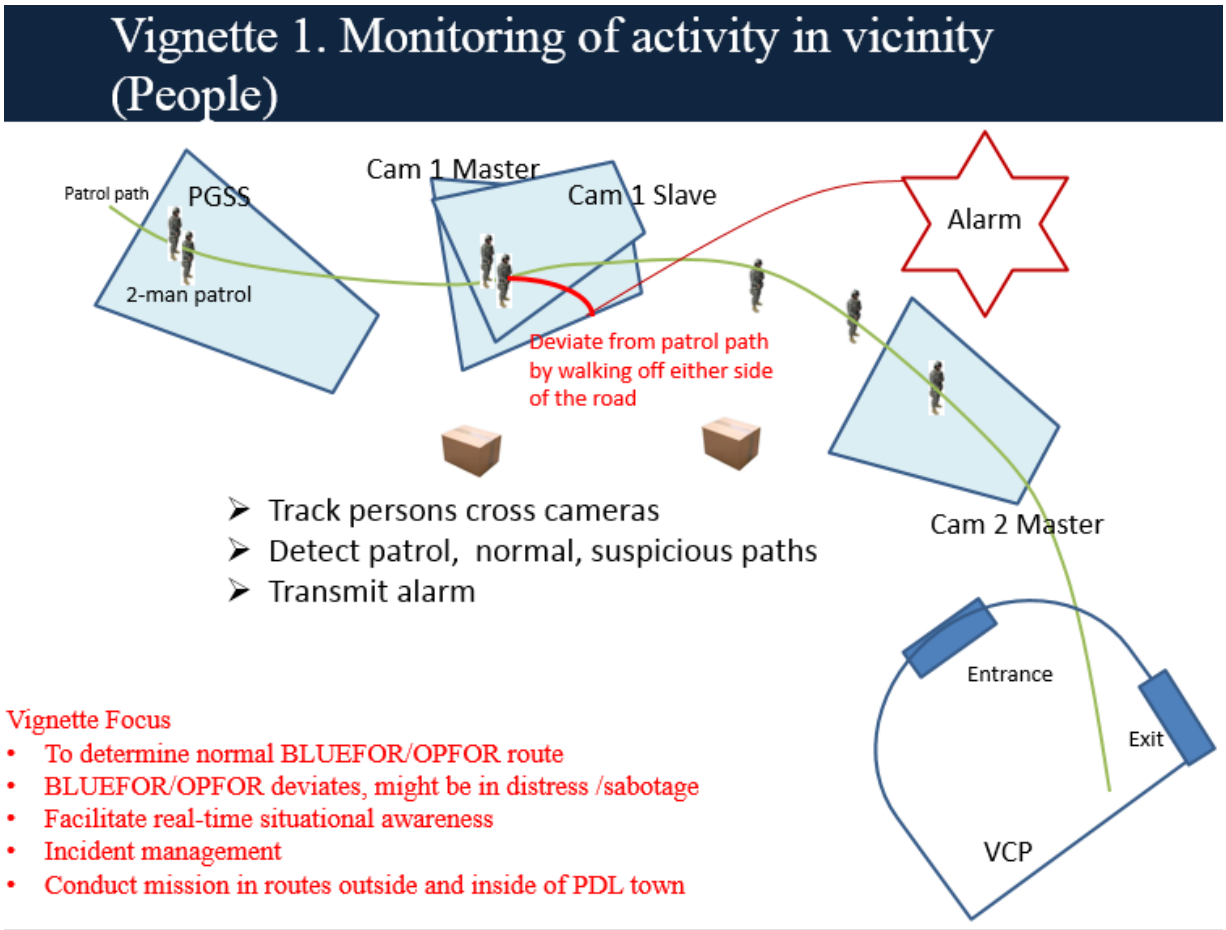


Figure 7: Vignette 1. Monitoring of activity in vicinity

Table 5: Vignette 1 Detailed Action Plan (DAVION)

Vignette 1: DAVION (Patrol)	
Scenario	**Action**
Conducting usual patrol in PDL town, or between PDL town and Aerostat locations	• Patrol user will deviate from route to the location of 2 suspicious items
The patrol route has been rigged with security cameras and smart software that can detect changes in expected activity	• All users receive an alarm that someone has deviated from the usual patrol route • All users except Patrol user use DAVION Map to determine if the alarm was triggered by a friendly or an intruder
The deviation was triggered by a friendly	• Users will contact Patrol user using the Chat feature to determine reason for course change
Patrol user has approached suspicious items and needs to notify other users	• Patrol user responds to other users with the Chat feature and updates that he is checking potential unknown items
Patrol user wants to know if the suspicious items are known items that have been documented previously	• Patrol user checks the Augmented Reality capability and determines one of the two items is known
One item is not known and needs to be documented	• Take photo of unknown item and document in DAVION Map app
The suspicious object detonates and you need to document our escape route	• Use WhiteBoarding to note safe meeting location • Send Chat to notify users of new WhiteBoarding information
VCP needs to recover Patrol user	• VCP users use WhiteBoarding to alter the safe meeting location and notifies the Patrol through Chat • VCP uses notes from WhiteBoarding and Map to navigate to Patrol user location

Table 6: Vignette 1 Detailed Action Plan (PGSS)

Vignette 1: PGSS (Patrol)	
Scenario	**Action**
The VCP receives intel from the GCS using the Chat feature relating to suspicious items.	• VCP users will slew the camera to the area of suspicion • VCP user will request the GCS zoom in on suspicious area using the Chat feature • VCP users tags the suspicious item location on the map feature
Patrol users are conducting usual patrol between PDL town and Aerostat locations.	• VCP users send Chat message notifying the patrol to investigate and photograph item • Patrol users navigate to tagged area using streaming video and Map features
The patrol has deployed, their location needs to be monitored.	• VCP users monitor troop deployment with Blue Force Tracking capability on the Map
Patrol locates the items.	• Patrol users take photos for VCP users and posts • Patrol calls VCP with telephone capability to confirm identification and ask for orders
One of the suspicious items explodes	• Patrol users use the Map to find a safe meeting/recovery location • Patrol users move to recovery location and tag recovery position
VCP sends response team to locate and recover patrol	• VCP users locate patrols recovery location using Map feature, take photo of location, and tag photo for after action

Vignette 2. Early detection and stopping of approaching vehicle

Vignette 2 used the PGSS and VA camera feeds to determine changes in the number of vehicle passengers (Figure 8). Users used applications to plan and navigate a search, and to share relevant information. Additionally, VA was used to detect human aggression. The vehicle began at the top of the small hill right before the PGSS location. Camera 1 was located near the top of the hill before the PGSS location. The second camera was located just past the helium tanks on the other side of the PGSS area. The final camera was located at the entry point to PDL Town near the guard shack. Tables 7 and 8 provide vignette 2 detailed action plans for PGSS and DAVION.

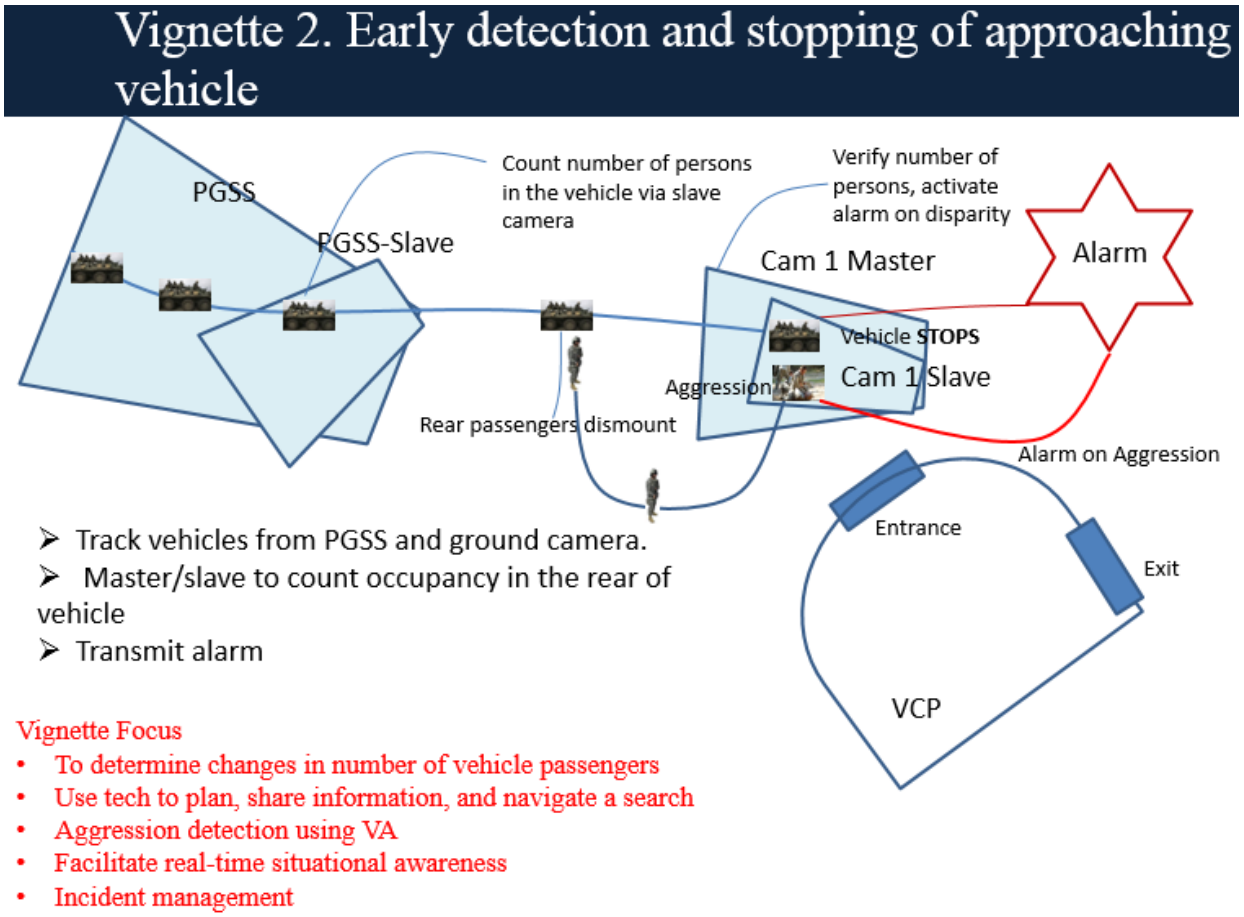


Figure 8: Vignette 2. Early detection and stopping of approaching vehicle

Table 7: Vignette 2 Detailed Action Plan (DAVION)

Vignette 2: DAVION (Vehicle)	
Scenario	**Action**
VA notices a suspicious vehicle that has fewer passengers than originally detected. An alarm is sounded on the DAVION sets	• Use DAVION Map app to view triggered camera • Use PGSS camera to survey area
PGSS camera reveals the vehicle has stopped in a different area closer to PDL town. The dismounted persons are near the helium truck.	• VCP user pins the vehicle stop and dismounted persons location in DAVION Map app • Use WhiteBoarding to plan search area where persons dismounted • 2 Search Users disperse to search for suspicious persons using DAVION Map, 1 remains at VCP • 2 Vehicle Users use AR to locate vehicle
Two search teams are deployed and need to be monitored by the VCP	• VCP user tracks searches with DAVION Map
The hostiles initiate an attack on the patrol once discovered. The VA cameras are able to detect aggressive activities	• Users engage hostiles with simulated aggressive force • VCP monitors the activity and sends backup • All users receive an aggressive activity alert
Hostiles are captured and vehicle is secured	• Use Chat to relay enemy is captured and vehicle is secured
Documentation is requested.	• Use Chat and take and send photos to the VCP

Table 8: Vignette 2 Detailed Action Plan (PGSS)

Vignette 2: PGSS (Vehicle)	
Scenario	**Action**
GCS sends Chat of noticed suspicious vehicle that has dropped off two passengers and continued along the road towards PDL town.	• VCP users pin the location of the dismounted persons • VCP users sends out an alert using the All Chat to all users • 2 Search Users disperse to search for suspicious persons
The vehicle has stopped in a different area closer to PDL town	• VCP user pins, slews camera if needed, the vehicle stop location in Map feature • 2 Vehicle Users disperse to search for vehicle, 1 remains at VCP
Two search teams are deployed and need to be monitored by the VCP	• VCP user tracks searches with Blue Force Tracking
The hostiles initiate an attack on the patrol once discovered.	• Users engage hostiles with simulated aggressive force at vehicle • VCP monitors the activity and calls for backup using telephone capability or Chat • All users receive an aggressive activity alert, All Chat
Hostiles are captured and vehicle is secured	• Use Telephone/Chat to relay enemy is captured and vehicle is secured
Documentation is requested.	• Users take photos and tag the images

Vignette 3: Mech Assault Focus

The focus of Vignette 3 was to provide users with exposure to potential uses of PGSS, VA, and DAVION technologies within a mechanized assault scenario. Users simulated that the Mech

Assault was occurring and were asked to work through the vignettes on their own to try to gain familiarity with the applications within the provided context. The users were provided a vignette focusing on using the applications as an attacker and a vignette for use as a defender. Tables 9, 10, 11, and 12 provide vignette 3 detailed action plans for PGSS and DAVION defenders and attackers.

Table 9: Vignette 3 Mech Assault Defenders (DAVION)

Vignette 3: DAVION (Mech Assault) (Defenders)	
Scenario	**Action**
Cameras are dispersed around PDL combat town and UAVs (Aerostat) are patrolling the area.	• Use the video feeds to detect the number of incoming vehicles and gain situational awareness

The enemy is using an unanticipated approach	• Use WhiteBoarding to adjust the response plan
	  • Tag response positions A, B, C on DAVION Map
	  • Deploying Users use AR to navigate to positions A, B, C

Troops have deployed based on the new response positions. Their locations need to be monitored.	• VCP users monitor troop deployment using DAVION Map
Need confirmation of arrival at response position	• Deploying Users send Chat notifying VCP of arrival at response position • VCP confirms correct position, and acknowledges arrival
Enemy forces have entered PDL town	• All users receive an alert the enemy has entered PDL town

Table 10: Vignette 3 Mech Assualt Attackers (DAVION)

Vignette 3: DAVION (Mech Assault) (Attackers)	
Scenario	**Action**
UAVs (Aerostat) are patrolling the area to help support the assault.	• Use the video feeds observe PDL Combat town and relay any useful info using the Chat and Map tagging capabilities
Based on the UAV info a new assault approach is needed.	• Use the Map tagging feature to drop attack positions A, B, C • Deploying Users use map to navigate to pinned positions
Troops have deployed based on the new response positions. Their locations need to be monitored.	• VCP users monitor troop deployment using DAVION Map
Need confirmation of arrival at attack position	• Deploying Users send Chat notifying VCP of arrival at response position • VCP confirms correct position, and acknowledges arrival
The town has been secured. Images of PDL town are requested by HQ	• Take photos of locations in PDL and tag on map

Table 11: Vignette 3 Mech Assualt Defenders (PGSS)

Vignette 3: PGSS (Mech Assualt) (Defenders)	
Scenario	**Action**
Cameras are dispersed around PDL combat town and UAVs (Aerostat) are patrolling the area.	• Use the video feeds to detect the number of incoming vehicles and gain situational awareness

The enemy is using an unanticipated approach	• Use Map to adjust the response plan
	  • Tag response positions A, B, C
	  • Deploying Users use Map to navigate to positions A, B, C

Troops have deployed based on the new response positions. Their locations need to be monitored.	• VCP users monitor troop deployment using Map
Need confirmation of arrival at response position	• Deploying Users send Chat or telephone call notifying VCP of arrival at response position • VCP confirms correct position, and acknowledges arrival using Chat/Call
Enemy forces have entered PDL town	• All users receive an alert the enemy has entered PDL town

Table 12: Vignette 3 Mech Assualt Attackers (PGSS)

Vignette 3: PGSS (Mech Assualt) (Attackers)	
Scenario	**Action**
UAVs (Aerostat) are patrolling the area to help support the assault.	• Use the video feeds observe PDL Combat town and relay any useful info using the Chat and Map tagging capabilities
Based on the UAV info a new assault approach is needed.	• Use the tagging feature to drop attack positions A, B, C • Deploying Users use map to navigate to pinned positions
Troops have deployed based on the new response positions. Their locations need to be monitored.	• VCP users monitor troop deployment using Map
Need confirmation of arrival at attack position	• Deploying Users send Chat notifying VCP of arrival at response position • VCP confirms correct position, and acknowledges arrival
The town has been secured. Images of PDL town are requested by HQ	• Take photos of locations in PDL and tag on map

DV Day Vignette

After completing separate training days using vignettes 1-3 outlined above, the Singaporean Guards and U.S. Marines returned on 18 December to rehearse vignettes for demonstration during DV Day. It was determined Vignette 2 provided the best demonstration opportunity. The vignette was slightly altered to integrate the use of both the DAVION and PGSS technologies. To help provide users with an engaging demonstration monitors were setup in the demonstration area to provide the visitors an on screen display of the PGSS GCS aerial view, the HQ/VCP

Users DAVION handset, and the HQ/VCP users PGSS handset. Table 13 provides the detailed action plan for the DV Day vignette.

Table 13: DV Day Vignette

DAVION and PGSS DV Day Vignette		
Scenario	**DAVION**	**PGSS**
VA cameras notice a suspicious vehicle that has dropped off passengers and continued along the road towards PDL town.	• All Users receive an alert • VCP User uses **Whiteboarding** to draws search route and **Chat** to tell Helium Team Users to deploy **[1 pax detected at tanks T1 deploy]** • Helium Team Users deploy to helium tanks to find dismounted person(s), when team arrives they will apprehend dismounted person(s) without aggression. **Tag** the location of the incident. Send back a photo and chat message indicating capture using **Chat All [1 pax captured]**	• When DAVION receives alert, VCP PGSS User slews camera to helium tank area • Monitor Blue Force deployment on **Map** to helium tank area
The vehicle has stopped at the guard shack in front of PDL town	• Vehicle Team will approach vehicle and ask driver questions regarding his purpose for being in the area. Team becomes suspicious and asks passengers to exit the vehicle.	• Vehicle Team will approach vehicle and ask driver questions regarding his purpose for being in the area. Team becomes suspicious and asks passengers to exit the vehicle
Upon exiting the vehicle the driver starts an altercation with a member of the Vehicle Team.	• All Users receive an aggression detection alert • Vehicle User engages passenger in fight and eventually subdues driver	• VCP User, when driver exits the vehicle slew camera to vehicle area • VCP User use **Chat** to request GCS zoom in on altercation • Vehicle User use **Telephone Call** feature to report back to VCP once driver is detained **[2 pax detained]**
All persons of interest apprehended	• VCP sends a **Chat All** to return to base • Take all persons of interest to guard shack	• VCP replies in call to return to base with apprehended person. • Take person of interest to guard shack

JNLW Demonstration

During the OUE event JNLW demonstrated two non-lethal technologies. The JNLW demonstration main operating window was from 12/10/14 to 12/20/14. During this time the JNLW team trained users on the use of the PEVS and the DSLA –Lite. The team utilized pre designed vignettes to provide training scenarios and demonstrate the participating technologies (Figure 9).

JNLW Vehicle Stopping Vignettes

- Vehicle Profiles
  1. Fast/Constant: Vehicle approaches VCP at 25 mph (doesn't slow or stop)
  2. Fast/Erratic: Vehicle approaches VCP at 25 mph (stops, starts, brakes, swerves)
  3. Slow/Constant: Vehicle approaches VCP at 10 mph (doesn't slow or stop)

4. Slow/Erratic: Vehicle approaches VCP at 10 mph (stops, starts, brakes, swerves)

- Run distance is approx. 750 meters from when car is initially detected until it hits the VCP gate
- We expect all NLWs engagements to take place between 750 and 200meters
- At 25 mph these engagements will only last 50-55 seconds before the cars are shot and killed

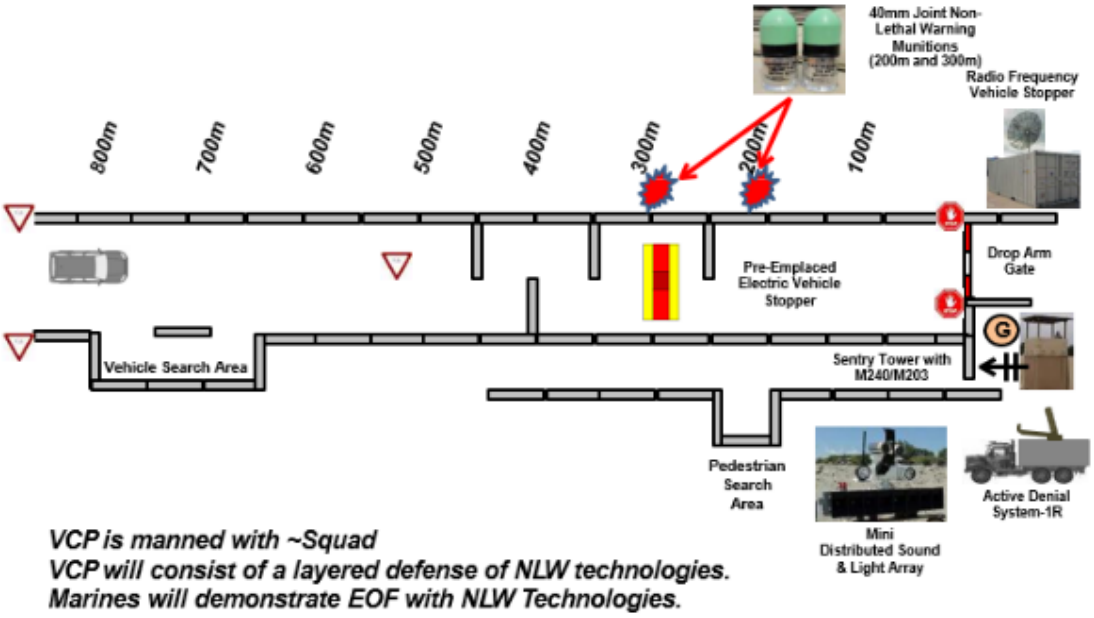


Figure 9: Vehicle Stopping Demo Layout

Mechanized Assault

On December 19, 2014, as part of Valiant Mark 14.2, a mechanized assault was conducted in various locations on Camp Pendleton. PDL Combat Town was one of the defending location during the assault. The town was occupied by two squads of the 1/5 Alpha Company U.S. Marines. A range of vehicles surrounded the town in under one hour, mid-morning, on the 19th (Figure 10).

Figure 10: PDL Town Mechanized Assault

As part of the OUE 14.2 technology demonstration and field experimentation 10 of the defending U.S. Marines were provided an hour long training session on the participating technologies. Five of those trained completed a full day of vignettes to help better expose them to the technologies and their capabilities. Vignettes were developed specifically to help the users determine potential uses for the technologies during the mechanized assault. After the full day of training and vignettes, those 5 Marines were able to go back to their team and provide more insight on the mobile application technologies. In the days leading up to the mechanized assault the defending Marines were able to employ other PGSS technologies to help plan their response (Figure 11).

Figure 11: U.S. Marines Tour PGSS GCS (Left) and Platoon Commander uses the PGSS COP to help plan a response (Right)

Users provided a lot of positive feedback regarding the usefulness of the OUE 14.2 technologies during the mechanized assault and similar scenarios. The users were able to communicate during the assault without giving away their positions, and monitor the approach of the attacking force. User comments relating to the use of the OUE 14.2 technologies during the mechanized assault can be found in the *DAVION and PGSS User Training and Vignettes* section of this report.

Distinguished Visitors Day

The OUE team hosted a Science & Technology (S&T) DV Day at PDL Combat Town, Camp Pendleton on 19 December 2014 (Figures 12, 13, 14, 15, 16). The purpose of the event was to highlight S&T projects as part of an effort to promote bilateral S&T collaboration between the MINDEF/SAF and U.S. PACOM. The event played a key role in highlighting the MINDEF and PACOM collaboration on technology experimentation. The S&T Distinguished Visitors Day consisted of technology briefs and a scenario based technical demonstration of new and emerging technologies that were currently engaged in OUE 14.2.

Over 60 guests attended the OUE 14.2 DV Day event. As the guests arrived they were lead into a covered pavilion area with bleacher seating. Displayed along one side of the area were posters providing information on each of the OUE technologies, and aspects of the integration process.

Additionally, a trifold providing a summary of the OUE 14.2 event and technology information was provided for attendees to read and take with them upon leaving the demonstration.

After the opening comments from the JNLW and OUE teams the DV Day attendees were asked to observe a live action scenario involving the PGSS aerostat, PGSS Mobile Client, VA, and DAVION applications. A small mobile COP was setup in the pavilion area that provided attendees a view of the overall aerostat view and the views on each of the handheld application platforms being operated by the Singaporean Guard and U.S. Marine users.

During the live action scenario the Singaporean Guards and U.S. Marines utilized all of the participating technologies to demonstrate the communications, information sharing, situational awareness, and aggression detection features of the technologies. The DV Day participants were very impressed with the capabilities demonstrated and provided positive feedback on the value of the communications features, aggression detection, and PGSS aerostat. Additional questions regarding aerostat payloads and implementation of the VA software were asked by attendees and addressed by the briefing technologists.

Figure 12: DV Day Static Displays (Left) and Demonstration Day Mobile COP (Right)

The following distinguished visitors participated in the OUE 14.2 DV Day:

- **Major General Lawrence D. Nicholson**, Commanding General, 1st Marine Division
- **COL Lim Siong Tiong**, Head Concept Generation Group, Future Systems and Technology Directorate
- **COL Tan Cheng Kwee**, Commander 7 Singapore Infantry Brigade (7 SIB)
- **Sergeant Major David L. Jobe**, Sergeant Major, 1st Marine Division
- **MWO (Master Warrant Officer) Sanjee Singh**, Brigade Sergeant Major, 7 SIB
- **LTC Fan Man Poh**, Commanding Officer, Guards Battalion
- **Capt Learlin J. LeJeune III**, Alpha Company Commander, 1st Battalion, 5th Marines
- **Capt Ryan Szabo**, S-2, 1st Battalion, 5th Marines,
- **1stLt David Deal**, Platoon Commander, Alpha Company, 1st Battalion, 5th Marines
- **Paul Funora** of NAVAIR (GS-15)

Figure 13: DV Day Guests and Organizers Mingle Before Opening Remarks

Figure 14: DV Day Guests Receive Opening Remarks from the OUE and JNLW Teams

Figure 15: DV Day Visitors View a Live Demonstration of OUE Technologies

Figure 16: MG Nicholsan, COL Lim Siong Tiong, and other DV Day Visitors Receive Briefs on OUE 14.2 Technologies

User and SME Demographics

This section provides a summary of the demographic information collected on the Singaporean Guard and U.S. Marine users, and the technology integration SMEs. User demographic summaries can be found in tables 14 and 15.

DAVION and PGSS Mobile Client User Demographics
13 Total Users provided survey feedback. Additional users were trained by the surveyed users to use the DAVION and PGSS Mobile Applications during the Mech Assault but those users were not available to fill out surveys. Additionally, some of the original U.S. Marines were not available for the DV Day rehearsal and demonstration. Those marines were replaced with new trainees who were quickly trained by the technologist and subsequently integrated into the vignette rehearsals.

US Urban Environment Experience
IRAQ deployment from 2008-2009 for stability operations in Al Anbar province.
Afghanistan Deployment in Helmand province 2010-2011
31st MEU deployment 2011-2012
UDP deployment to Australia 2013-2014
Training in MOUNT environments, Urban Combat Towns, including annual training

Singaporean Urban Environment Experience
Annual Urban Environment Training

US HADR Experience
None

Singaporean HADR Experience
Local peacekeeping exercises

*All users noted that they owned smart phones and were very comfortable using smart phone applications.

Table 14: User Demographics by Technology

	DAVION Users	PGSS Users	Total Users
Singaporean Guards	**3**	**3**	**5***
U.S. Marines	**4**	**4**	**8**

*Due to changes in the Mech Assult and demonstration requirements one Singaporean user was trained on both systems and provided feedback on each of the systems.

Table 15: User Experience Demographics

	Average Years in the Military	MOS Represented	Average Years in MOS
Singaporean Guards	**3.5**	**Infantry Specialist Infantry Rifleman**	**NA**
U.S. Marines	**3.1**	**Machine Gunner Rifleman**	**2.9**

SME Demographics

A total of eighteen surveys were completed by technologies participating in the integration process during OUE 14.2. The respondents represented A-STAR and ST Electronics, DRG, and the JHU-APL and PGSS team. Many of the respondents had previous experience with the participating technologies and with previous OUE events.

SME Relevant Experience

Afghanistan deployments with PGSS
John Hopkins University Applied Physics Lab
Previous OUE events
Designers, IT, Field, Integrators, Operator

PGSS/VA/DAVION INTEGRATION RESULTS

This section provides a summary of the overall integration process of OUE 14.2 technologies during VM 14.2, including difficulties and successes, the objectives and measure used to collect data, and feedback collected from users and SMEs. The observations collected in this section of the report were recorded by an independent IT SME who was not affiliated with any of the participating technologies. A diagram of the final technology integration setup can be found in Figure 23.

During OUE 14.2 the PGSS system and mobile client, Visual Analytics Software, and DAVION applications were demonstrated in and around PDL Combat town with users from Singapore Armed Forces and the U.S. Marines.

Basic Integration Setup

The PGSS System utilizes an aerostat as the central hub of data dissemination (Figure 17). The Aerostat deployed a single camera that provided an aerial view of the area and zooming capability. Additionally, seven VA cameras were deployed to provide coverage for the demonstration of the change and aggression detection capabilities of the system. The Aerostat camera video feeds flowed through the attached single mode fiber tether to the servers inside the GCS where the feeds were processed. From there, if the phones were using LTE, the data was sent back up the tether, and broadcast to the smartphones on the ground. If the phones were using Wi-Fi, the feed flowed through the wired and wireless network to the smartphones. The ground based camera video feeds were transmitted via a wireless network device to the to the nearest Wi-Fi access point and through the wireless and wired network back to the Singaporean servers connected to the GCS, finally following the same path as the LTE.

Figure 17: PGSS Aerostat (Left) and PGSS Aerostat Camera Setup (Right)

OUE utilized a backhaul internet connection. This connection originated at the GCS and allowed the smartphone users on the ground to make calls outside the local network to the rest of the world utilizing 4G LTE service provided by Verizon. A large antenna on top of the GCS provided for a dependable uplink despite the remote location.

To facilitate the integration of the PGSS and Singaporean technologies, the PGSS team provided network connectivity and static IP addresses (.210 - .240) for use by the Singaporean technologies. The equipment provided by the Singaporean team included:

- Seven AXIS P5532 PTZ dome cameras
  - PTZ (Pan Tilt Zoom) security cameras rated for outdoor use
  - 10/100 Ethernet Port, 29x optical zoom, H.264, Maximum 720x480 resolution
  - Most cameras had both a wired 10/100 Ethernet and wireless connection available; the final configuration for the demonstration consisted of five wired cameras and two wireless.
  - Each camera had an available wireless connection:
    (1) Outdoor Wireless Network Adapter Model: TP-Link TL-WA7510N
    (2) Wireless-N, 5Ghz, 150Mbps
  - The cameras and network adapters were powered using PoE power supplies and generator(s)
  - Each camera and network adapter was mounted on 1x Hercules Gear Up Speaker Stand
    (1) Cameras 1 and 2 were mounted together on a single stand
- One Asus AC1900 gigabit router, wired to the main PGSS router, providing ports for:
  - Four Dell laptops for video analysis / monitoring / configuration purposes
- One Dell laptop located in the GCS and wired directly to the PGSS router.
- Smartphones (approximately 5-10 phones, using LTE or Wireless-N)
- Several large directional 5ghz antennas, that were not used in the demonstration

Additional network hardware provided by PGSS to support DAVION network connectivity included:

- One layer 2 gigabit switch, providing wired connectivity to cameras 1 & 2 over a single Ethernet uplink cable back to the GCS.
- Three Cisco Aironet 1552 Wireless-N Access Points
  - One inside PDL combat town, one outside PDL combat town, and one at the GCS
  - Configured in mesh mode to directly communicate with each other
  - Wireless-N network (both 2.4ghz and 5ghz) for cameras and smartphones

VA Camera Setup

The VA camera team worked throughout the OUE 14.2 event to ensure a successful integration of their technology with the other participating technologies. SMEs diligently tweaked camera locations and the VA software, conducting daily tests to optimally train the VA software training and demonstrations (Figure 18).

Figure 18: VA Camera Placement, Programming, and Troubleshooting

Three AXIS P5532 IP Cameras (#5-7) were deployed within PDL Combat Town to support the data collection effort and the Mechanized Assault on the 15th December (Figure 19).

- Video streams from each camera was processed to determine the GPS coordinate of each human detected. Coordinates were recorded in the database for consumption/retrieval via the DAVION handsets.
- Each camera was mounted on a stand located on the building roofs, overlooking the combat town to minimize obstructions.
- Each camera was pre-calibrated and configured for a predefined camera view.
- Each camera served a specific role in the vignettes, providing feeds for the video analytics module to perform initial people count and vehicle tracking for the 2nd vignette.

Four AXIS P5532 IP Cameras (#1-4) were deployed between the PDL Combat Town and PGSS Ground Control Station to support vignettes and the Mechanized Assault (Figure 20).

- The video analytics module operating on camera 1 supported the 1st and 2nd vignettes.
- In the 1st vignette, the cameras learned the 'normal path' of patrol executed by a foot patrol and alerted the DAVION handsets upon detecting deviation from this normal path. In the 2nd vignette, the cameras performed a secondary count of the people in the vehicle and alerted the DAVION handsets upon detecting a discrepancy with the initial count.
- Camera 3 was situated closest to the Vehicle Control Point (VCP) and its analytics module performed aggression detection during the 2nd vignette.
- All four cameras performed vehicle detection, tracking, and counting during the Mechanized Assault

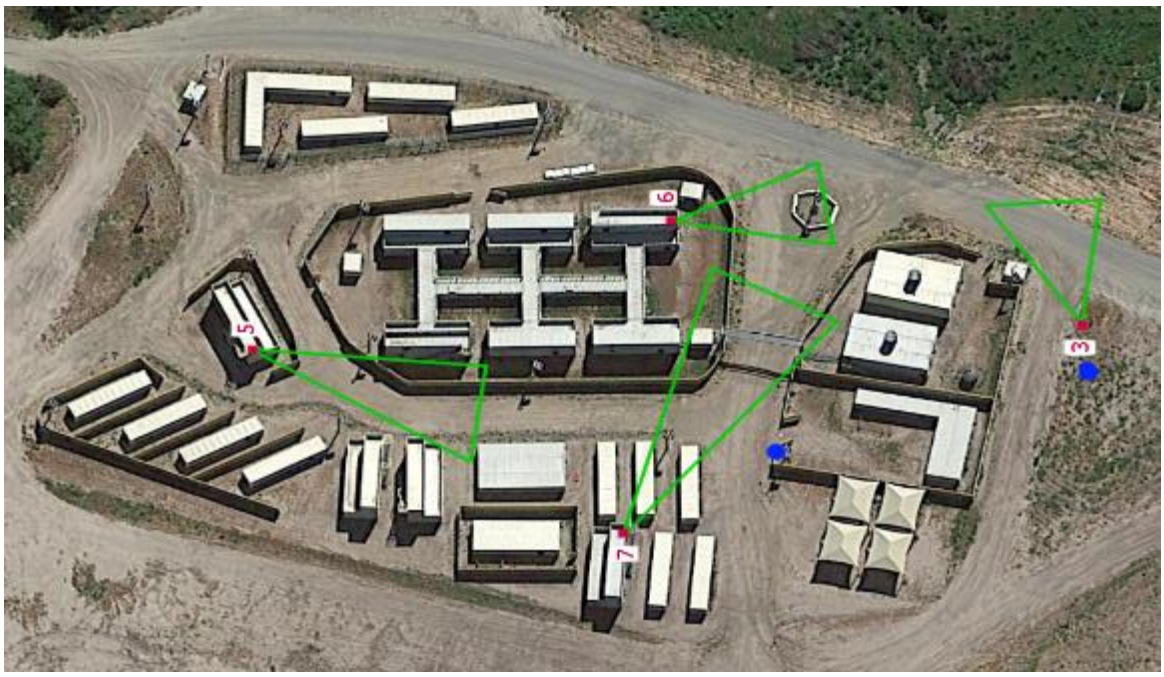


Figure 19: PLD Combat Town Camera Placement

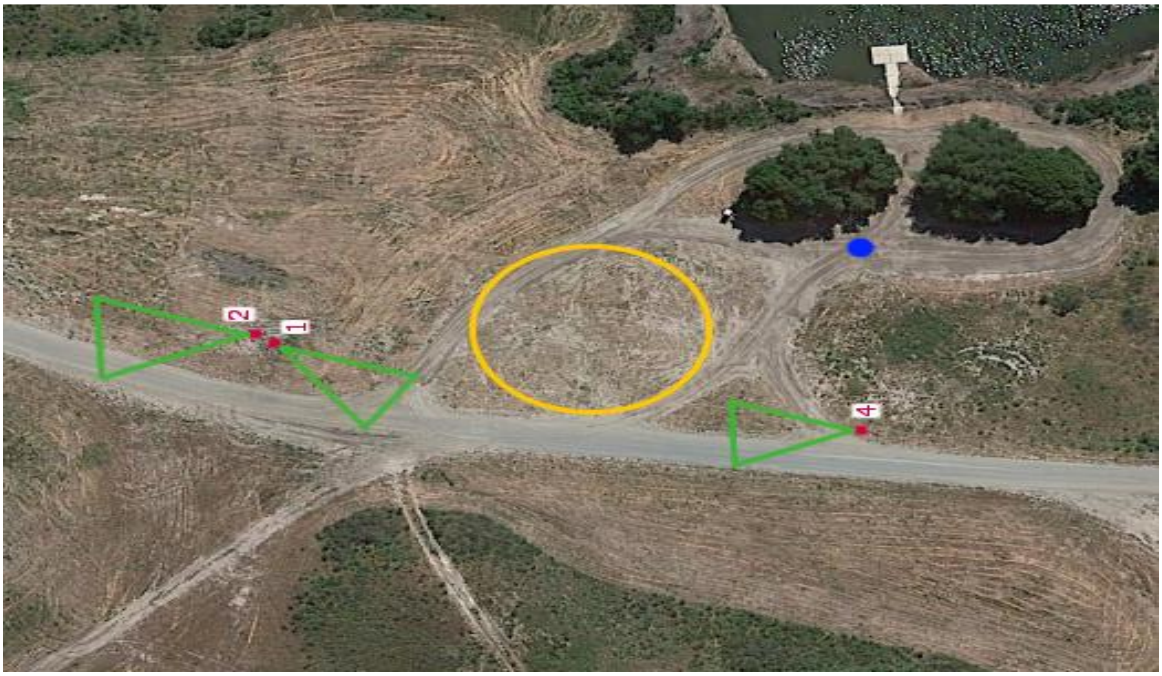


Figure 20: Camera Placement in PGSS Area

Evolution of the Integration Process

Wireless-N
The Wireless-N network was a work in progress throughout most of the two week period. Providing both 2.4 GHz and 5 GHz frequencies, there was a single SSID used for the entire network. The Cisco APs were moved several times until optimal locations were found. Originally there was a Cisco AP mounted on the aerostat, but once the aerostat was raised the signal quickly vanished. This is most likely due to the antennas used on the Cisco AP, which pointed outward (parallel to the horizon), rather than downward to the ground, and the 1000' height of the aerostat when raised.

The original plan integration plan was to connect all of the cameras on the ground to the network via Wireless-N. However, during the integration process it was determined that the AXIS Cameras and DAVION server software do not handle packet loss well. Two dropped packets in a row meant loss of the video feed at the server for up to 20 seconds; which resulted in a failed test in our scenarios. As a result, Ethernet was run to nearly every camera location and the majority of the cameras were wired for the demonstration. However, due to the physical limitation on length of Ethernet cable of 100m, two of the cameras (3 and 5) were wireless. These cameras had a direct line of sight to a Cisco Access Points so there were no issues with these cameras during the demonstration despite the range (especially Camera 5, which was 382 feet away from the switch in PDL Combat Town).

Power over Ethernet (PoE)
After discovering the Axis cameras were PoE capable, each was wired and powered from the Cisco PoE switch located in PDL Combat Town. It was hypothesized that this would eliminate their dependence on Wireless-N for their network connectivity as well as the need for small generators at each location. However, after failing to power an Axis camera from the switch we determined that the Axis camera is not compliant with 802.3af, the standard Power over Ethernet that can supply up to 15 watts (and what the Cisco switch is capable of). The cameras were compliant with the IEEE 802.3at; this is known as High Power over Ethernet, which can go as high as 30 watts. The switch wasn't able to provide enough power to the camera, so generators were ultimately used to power each camera.

Inputting the aerostat camera feed into DAVION
The PGSS camera feed streamed to the Video Analytics Milestone VMS for real-time processing. During the mechanized assault and 2nd vignette, the PGSS stream was processed for vehicular detection, tracking and counting. In the 1st vignette the PGSS stream was processed for human detection and tracking.

There were two parts to the video feed from the PGSS camera. The first was the HD video feed from the MX15 camera itself, and the second was the telemetry data which provides metadata regarding camera direction, modes, GPS coordinates, zoom levels, etc. This metadata was encoded in a proprietary KLV (Key-Length-Value) format that the DAVION system could not process. The Aegon server expert was able to encode the metadata using a different format known as JSON (Javascript Object Notation), which is a format compatible with DAVION (Figure 21).

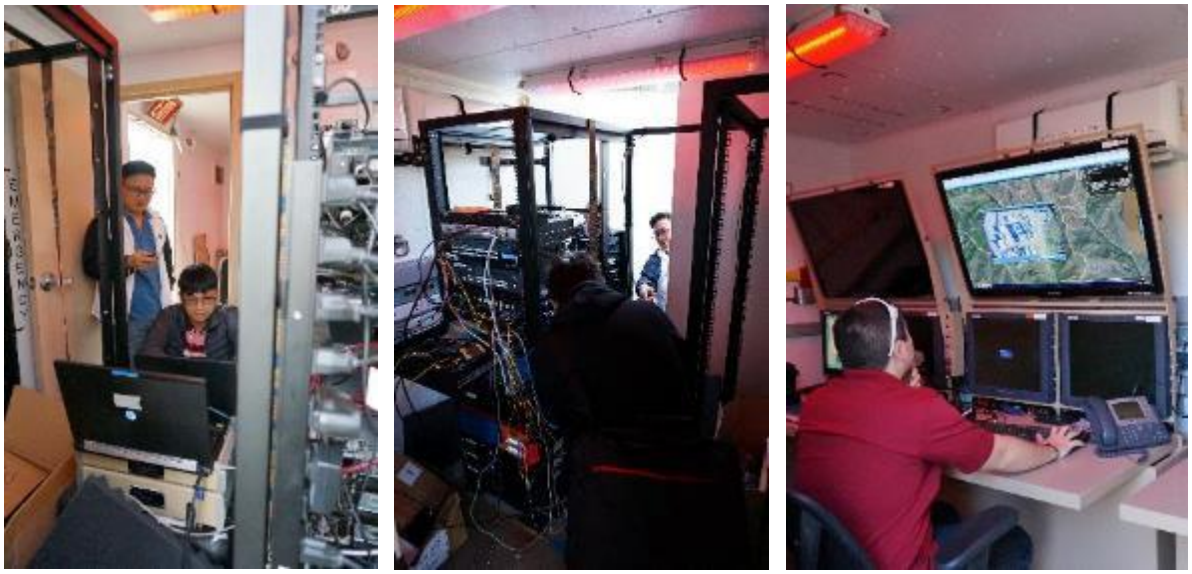


Figure 21: DAVION and Aegon Technologist Integrating the Aerostat Feed into DAVION

Inputting the Ground camera feeds into Aegon

Multiple issues were encountered while attempting to get the video feed from the ground cameras into the Aegon system so they could be sent to the PGSS Smartphones. Multiple video profiles were tested until finally the H.264 pass-through profile in Aegon was able to import the raw feed directly from the camera; attempting to input the processed RTSP feed from the VA server continually crashed the Aegon server. Also, attempting to use any other video profile resulted in the Windows process cycling on and off repeatedly, which would raise the memory usage to alarming levels, and the process had to be stopped from the Windows Task Manager; it could not be stopped from the Aegon dashboard. In order to input the feeds directly from the camera into Aegon, the Axis driver had to be loaded on the (Microsoft Windows based) Aegon server. Configured with more than a single ground camera feed, the Aegon process would slow down considerably; this was noticeable during testing by the end users in the form of lag (the amount of time it would take between attempting to slew the camera and when the camera actually slewed).

> **Observation:** More testing needs to be done to document the proper settings and configuration necessary for Aegon to handle the processed video feeds from DAVION without crashing or slowing down.

Aegon Server

PGSS brought both a primary and a backup Aegon server for the demo, and both were needed. In addition to the troubles outlined above, the primary server also went down during the integration process and would not boot back up. It was determined that a bad ribbon cable inside the server was the issue. Since the ribbon cables only purpose is to connect an internal capture card that wasn't being used for this exercise, both items were removed and the server then booted.

> **Observation:** One of the lessons learned was that the Aegon representative should be on site for the entire integration process. The Aegon representative departed after the initial integration period and multiple problems, as described above, occurred. This resulted in

other participants being pulled away from their own technologies to trouble shoot the Aegon issues. It is likely this wasted valuable training and integration time as the Aegon representative would have been able to address the issues more efficiently.

DAVION Server Setup

The Singapore server setup included 5 Dell Alienware laptops:

- Video Aggregator : One laptop collected the video feeds from all seven cameras
- Video Analysis: Two laptops ran video analysis on feeds from the aggregator
- Database Server: One laptop was used for the MySQL database server
- Workstation: One laptop served as the main workstation for configuration

The Video Aggregator was located inside of the GCS, while the other four laptops were located on a table next to the GCS and connected via a wired Asus gigabit router.

While doing a dry run on the vignettes, the video analytics application on the DAVION server kept crashing. The Singaporeans were able to make code changes on the fly to fix the problems as they kept popping up.

Observation: More work is needed to ensure DAVION is a fully functioning application and service

Mech Assault and Tactical Fiber

For network connectivity to the PDL Combat Town, a tactical fiber was run from the GCS to a building inside PDL Combat Town, where a network switch, VOIP phone, and Cisco Wireless AP were placed. During the Mech Assault this tactical fiber was run over by one of the AAV's tracks and was severed. As a result one would expect that all three cameras in the PDL Combat Town would drop offline, but only the feed from Camera 6 was lost; at the time it was the only hardwired camera, while Cameras 5 and 7 were wireless; the mesh network configured on the Cisco Access Points enabled them to fall back to using wireless once the wired connection was lost. A new tactical fiber was run prior to the main demonstration on December 19th.

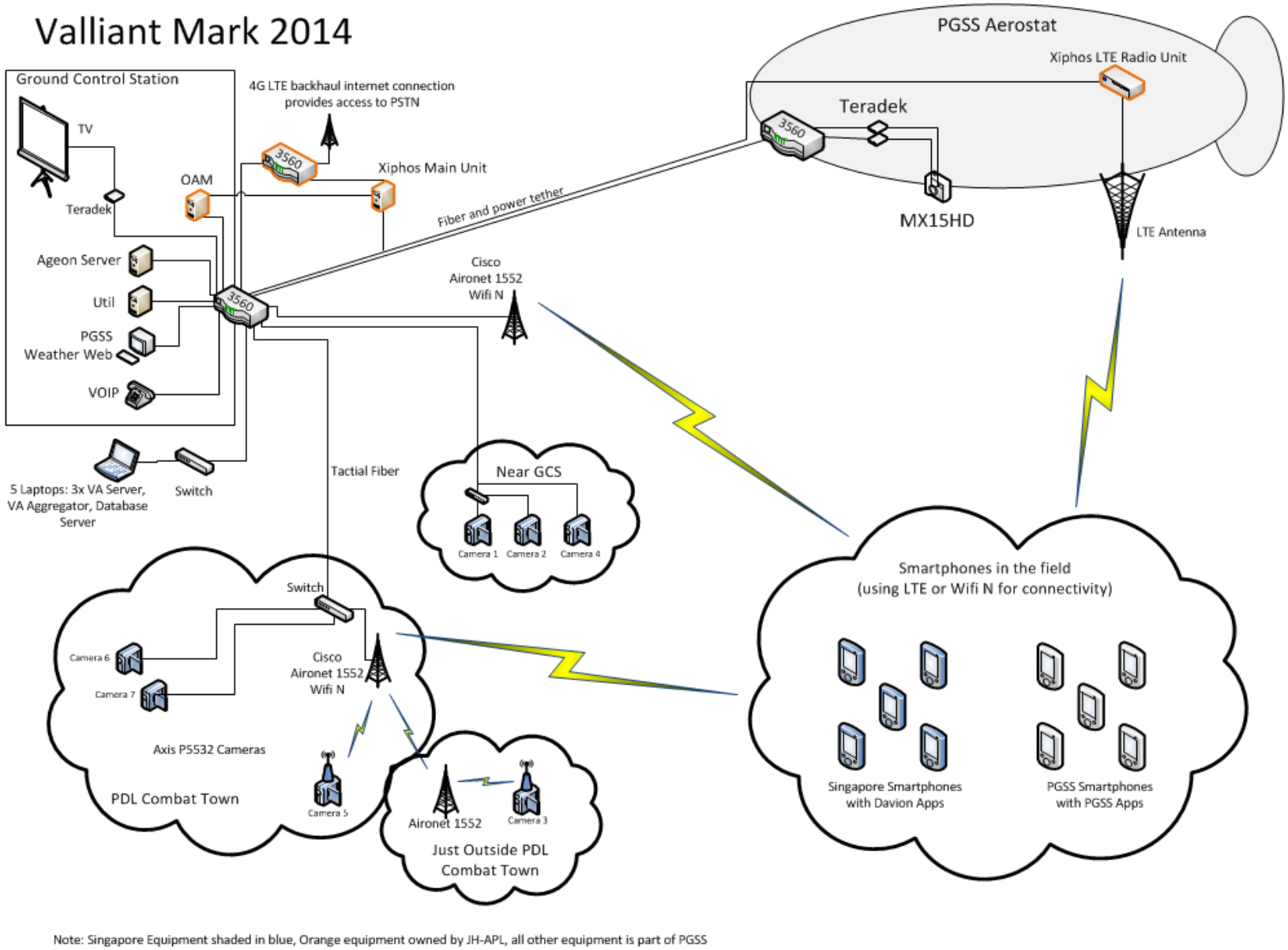
Original LTE Plan

During the final site survey SMEs from JHU-APL brought equipment to conduct initial testing of the LTE cell phone capabilities at PDL Combat Town. In conjunction with the Pendleton RF team, it was determined that AT&T is using Band 17 to provide commercial cell phone service to the area. Band 17 ranges from 734 to 746 MHz for the downlink; AT&T's service is focused on the low end of that range. This was also the same range the PGSS equipment planned to utilize for OUE 14.2. To prevent overstepping AT&T's commercial service, the Pendleton RF team asked PGSS to use the top end of that range and to use a 5 MHz channel instead of the usual 10 MHz. Therefore the most likely range used by the Aerostat for LTE service for OUE 14.2 was from 741 to 746 MHz. It was noted that using a smaller channel would result in lower bandwidth available to the phones. However, as long as the number of phones was limited (less than 15 phones), it should not have a significant effect on the event. The Aerostat could also provide a wireless N network to the smartphones, which was the backup solution if there were problems utilizing LTE due to the above restrictions or other interference.

Final LTE Plan

Ultimately Band 4 was used instead of Band 17. Band 4 uses a different frequency range (1710 – 1755 MHz for transmit, 2110 – 2155 MHz for receive) and thus required a different Xiphos Radio Unit that JHU-APL brought to the event. This band resulted in less interference than Band 17 would have caused to AT&T customers in the area. The same 5 MHz channel size restriction discussed above still applied. In the end this did not negatively affect the test due to the limited number of smartphones being used. While the Xiphos Radio unit located on the aerostat is capable of outputting 60 watts, most of the exercise was run at 10W. Additional wattage does not provide additional range but a stronger signal within the same range. During testing it was determined that outputting 10 watts would provide adequate coverage for the exercise area (Figure 22).

Figure 22: JHU-APL and PGSS Technologists Work to Integrated the 4G LTE Capability



Note: Singapore Equipment shaded in blue, Orange equipment owned by JH-APL, all other equipment is part of PGSS

Figure 23: Final OUE 14.2 Network Diagram

4G LTE Range Testing

This section provides details on the limited range testing conducted on 16 December 2014 as part of the OUE 14.2 integration and demonstration event. Participating JHU-APL and PGSS team SMEs conducted basic range testing on the PGSS Mobile Client handhelds using the 4G LTE capability. Each test was conducted with the following limitations:

Limitations: To minimize commercial LTE interference, this test was conducted using a band 4 radio (instead of the previously tested band 17 system) with transmit power decreased to 10W (instead of 60W) and a patch antenna pointed downward (instead of an omnidirectional antenna).

Test 1

Situation: Weather was overcast, but otherwise good. Driver with a single device started driving from the PGSS site near PDL town off the range until signal loss. The PGSS was used to measure the distance between the start location and each stop or ending location.

Technical Specifications
UL 1732.5 MHz
DL 2132.5
Band 4
Power 10W

Findings: At 1.27 miles the camera feed was lost, but the blue-force tracking icon for the driver remained and the Chat feature still functioned. The driver was also unable to make a phone call at this distance. When the driver started to return the blue-force icon remained frozen on the handheld at the 1.27 mile location. The icon for the driver did not show up on the GCS at this distance. At .76 miles the driver reappeared on the GCS and on the driver's handheld. The driver was able to slew the camera at .76 miles.

Test 2

Situation: It was suggested that the metal body of the vehicle might be creating some interference so during this run the driver, and an additional passenger with a handheld, stepped out of the car to conduct testing.

Technical Specifications
UL 1732.5 MHz
DL 2132.5
Band 4
Power 10W

Findings: The users were able to slew the camera, Chat, and use the video feed at .87 miles. The levels fluctuated a lot at this range and the signal was not picked up inside of the vehicle. At 1.01 miles a test phone call was completed successfully and the Chat function was used. At about 1.27 miles the vehicle devices dripped. The icons disappeared from the GCS feed but remained on the handheld device inside the GCS. The users rebooted and their location reappeared on the GCS. On the return, at 1.15 miles the users were able to successfully complete a phone call and use the Chat feature.

Test 3

Situation: The users started from their last position 1.15 miles with power raised to 20W. All phones had to reconnect before proceeding.

Technical Specifications
UL 1732.5 MHz
DL 2132.5
Band 5
Power 20W

Findings: At 1.43 miles the users were able to successfully complete a phone call, blue-force tracking worked, and they were able to successfully use the Chat feature.

Conclusions: Based on this limited testing, the aerostat-based 4G-LTE system performed as expected and demonstrated the ability to support the mission, providing voice (private and public network), chat, and the platform video and common operational picture to the warfighter. For this exercise, the LTE range was intentionally restricted to cover only the exercise area of operations; previous testing of the system demonstrated these mission functions out to 10 miles.

OUE Technology Integration Functional Areas, Objectives, and Measures

This section identifies the measures that were used to collect data on the integration of the PGSS, VA, and DAVION capabilities during OUE 14.2. The TEC assessment team addressed the measures using the data sources identified in the following tables. All results are supported by observations and user comments when available.

Functional Area A-1: Integration and Interoperability
Can the PGSS, PGSS Mobile COP, VA, and the DAVION applications successfully work together to support scenario requirements?

Objective A-1.1: Technology Integration
This objectives seeks to observe and assess the integration of the identified technologies. In this context integration is defined as the merging or combining of two or more components or configuration items into a higher level system element, and ensuring that the logical and physical interfaces are satisfied and the integrated system satisfies its intended purpose.

Table 16: Objective A-1.1 Data Matrix

Measure	Source	Product
ObjectiveA-1.1: Network/Camera Integration		
Measure A-1-1-1: Steps required to integrate the PGSS, PGSS mobile COP, VA, and DAVION	Event Logs, Interview, Questionnaire	Table, Text
Measure A-1-1-2: Issues arising from the integration of PGSS, PGSS mobile COP, VA, and DAVION	Event Logs, Interview, Questionnaire	Text
Measure A-1-1-3: SME Rating of the integration of the identified technology	Interview, Questionnaire	Text, Bar Chart

Objective A-1.2: Technology Interoperability and Dissemination

This objectives seeks to observe and assess the interoperability of the identified technologies, and the ability of those technologies to effectively disseminate needed information. In this context interoperability is defined as the ability of two or more systems or components to exchange information and use the information that has been exchanged. In this context effective dissemination is the ability for the identified technology to provide/share the data specific to that technology, as expected, using the network configuration designed to support the event. Current excepted range of the PGSS is defined as 10 miles.

Additionally, event logs will be used to record any issues, to include the circumstances, impact on the mission, technology configuration changes, and resolutions.

Table 17: Objective A-1.2 Data Matrix

Measure	Source	Product
Objective A-1.2: Technology Interoperability and Dissemination		
Measure A-1-2-1: Observations on the overall interoperability of the identified technologies	Interview, Questionnaire Data collectors Observations,	Table, Text
Measure A-1-2-2: Interoperability issues with the identified technologies	Event Logs Interview, Questionnaire	Table, Text
Measure A-1-2-3: User Ratings of the successful interoperability of the identified technologies	Interview, Questionnaire	Text, Bar Chart
Measure A-1-2-4: The identified technology disseminated data as expected	Interview, Questionnaire Data collectors Observations,	Table, Text
Measure A-1-2-5: Determine the effective range of the identified technology	Event Logs Interview, Questionnaire	Table, Text
Measure A-1-2-6: Validate the PGSS telephone capability	Event Logs Interview, Questionnaire	Table, Text

OUE Integration Survey Results

This section provides the survey feedback collected from participating users and SMEs during the OUE 14.2 technology integration event.

Measure A-1-1-1: Steps required to integrate the PGSS, PGSS mobile COP, VA, and DAVION

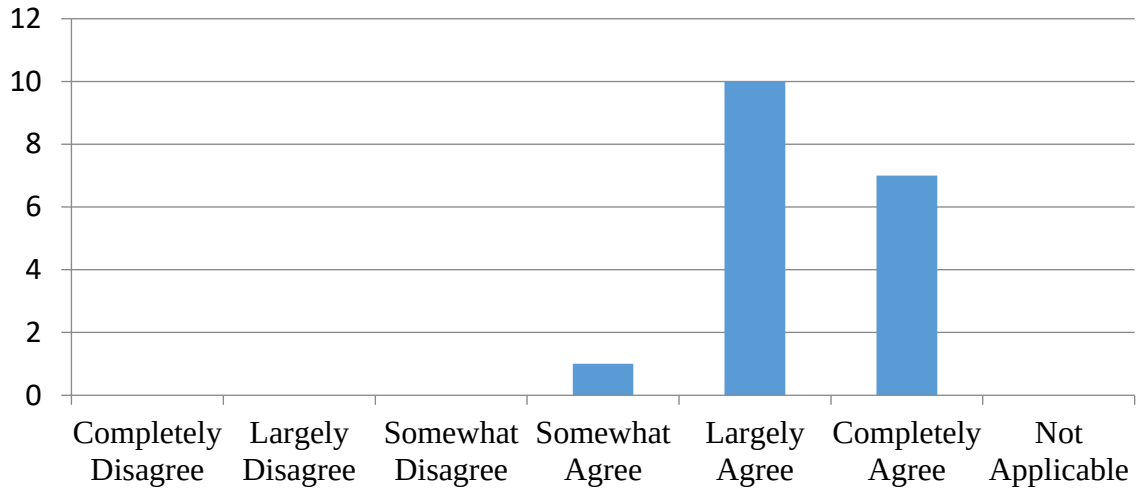
- This measure is addressed in detail in the previous section “Technology Integration”

Measure A-1-1-2: Issues arising from the integration of PGSS, PGSS mobile COP, VA, and DAVION

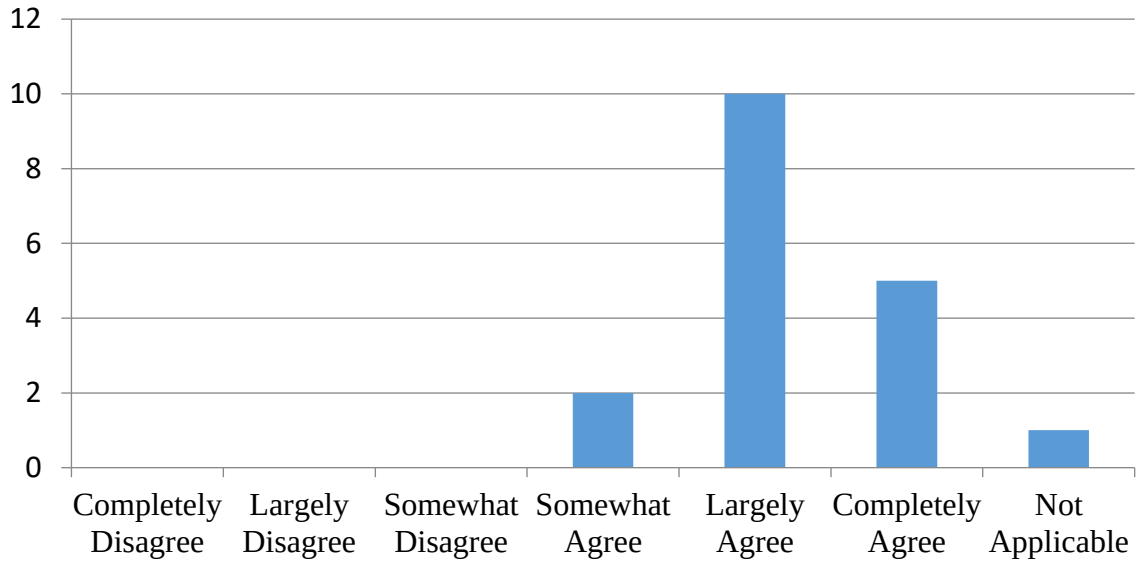
- This measure is addressed in detail in the previous section "Technology Integration"

Measure A-1-1-3: SME Rating the integration of the identified technology

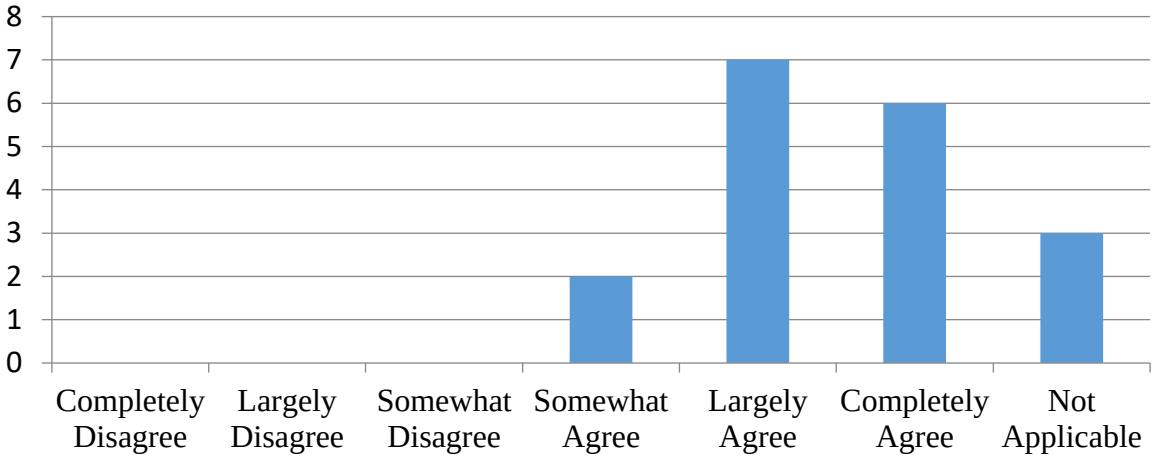
The process to integrate the PGSS with other technologies during OUE 14.2 was successful.



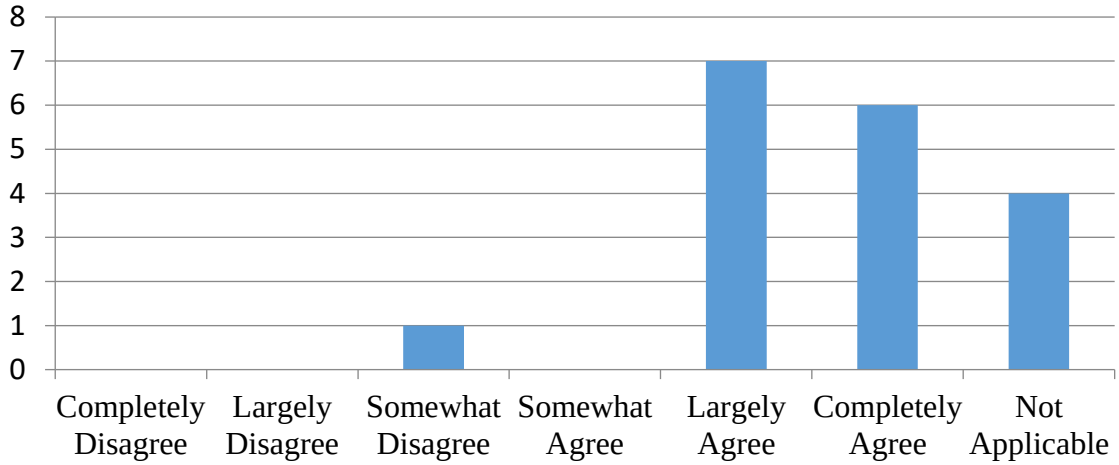
The process to integrate the PGSS Mobile COP with other technologies during OUE 14.2 was successful.



The process to integrate the VA with other technologies during OUE 14.2 was successful.



The process to integrate DAVION applications with other technologies during OUE 14.2 was successful.



If you chose an answer other than Largely or Completely Agree in one of the above questions please describe any integration issues you recall with PGSS, PGSS Mobile COP, VA, and/or the DAVION applications, and <u>provide feedback on the integration process as a whole.</u>

- One of the things that would have helped the integration process would be to know more about the infrastructure on the terrain to setup a better wireless network for devices to communicate on the network. There was a lot of interference that caused lag on the network due to buildings. Also to learn more about the different technologies involved prior to deployment.
- Network, power, camera issues were encountered on a daily basis
- We managed to get the LTE capabilities working fairly easily. I largely attribute this to a significant amount of preparation testing in the lab and in the field
- For integration between PGSS Mobile COP and VA, perhaps a more advanced technical information exchange should have been done. I got the feeling that software changes were being done, which could have been done prior to this test

- The DAVION application continued to crash the COP servers, this I believe could be resolved by DRG and the DAVION reps communicating to resolve this issue. The COP does not run like a normal operating system, therefore research between the two would greatly benefit this effort. As a whole the integration process went well, the extra time allocated to this process help greatly.

Measure A-1-2-1: Observations on the overall interoperability of the identified technologies
Measure A-1-2-2: Interoperability issues with the identified technologies

What would you describe as the biggest challenge to integrating the technologies that participated in OUE VM14.2? (SMEs)

- Change in schedule and weather
  - Availability of the guards
    - *Guards visited two days earlier than scheduled significantly reducing integration time
- Stabilizing the network for Wi-Fi and 4G
- Time changes for setting up the stations
- Communication and synchronization between different parties working on the different technologies
- One of the biggest challenges was integrating some of the unknown technologies for the first time without going through an R&D phase. It would have been easier to test the different technologies together prior.
- The integration of the DAVION software in to the Ageon software. It was initially difficult to get it to work but once the DAVION software was routed straight into Ageon it seemed to work well. It was a matter of having more time to integrate and test the software prior to the actual mission. If we were allowed the initial two weeks to test and integrate all issues would have been worked out prior to the actually week of testing. I believe the fix would be to allow for longer integration and testing to "BURN" in the software.
- The largest challenge was integrating the COP servers with the DAVION software.
- The amount of time that we had to integrate the systems. Most of the technologies had to be set up on the spot and needed to be up and running within 3 days
  - *Guards visited two days earlier than scheduled significantly reducing integration time
- Fiber optics
- The biggest challenge was contention for the resources. Everyone was trying to use the same cameras and at times our goals conflicted. In the end it all worked well.
- From an LTE payload perspective, frequency clearance was a major challenge. The payload was developed to operate in areas where LTE Band 17 (700 MHz-AT&T owned in most areas of CONUS) is not used. In order to operate at Camp Pendleton, we (JHU/APL) had to make a last minute switch to the LTE Radio & antenna setup. APL worked with NAVAIR to resolve the issue, but additional consideration should be given to frequency clearance in the future.
- We needed PGSS at a fixed position. This caused some integration difficulties with VA
- Network drops

- The biggest challenge was integrating systems into the GCS that have never been integrated before but thankfully all the right personnel were on site to complete the task in a timely manner. Some of the necessary equipment wasn't brought out on the first day such as CAT5 cable but luckily most of the equipment was easily obtainable at local stores.
- The integration time was too short
- The time was too short for integrating VA given the unfamiliar environment. The environment posed some unexpected challenges for the ad-hoc camera and data network setup, which in the end delayed the progress of the VA software
- Hardware failures; network, generator, cameras, etc.
- Early provision of VA streams to PGSS might have potentially avoided some issues regarding stream playback on PGSS COP
- Schedule cuts; reduction in the number of days for integration/testing etc., shortened the buffer time to cater for unforeseen hiccups.
- Network Issues
- Limited cooperation between teams
- Misunderstandings about technology requirements
- Schedule changes
- The final requirements not conforming to the original expectations

What would you describe as the biggest success during the OUE 14.2 integration process? (SMEs)

- All technologies are working together
- Full integration of PGSS/VA/DAVION as unique systems; PGSS as sensor, VA for the analytics and DAVION as user interface
- Integration with VA and DAVION handsets was largely successful as compared to XVM 14.1
- One of the biggest successes was that we achieved full system functionality with the limited time we had to test
- The biggest success was the full integration of all the systems being presented before the demonstration actually took place.
- Integration of PGSS video feed into VA processing
- Incorporation of all sensors and VA processing machines onto a single combined network
- Vignette demos that incorporate PGSS, DAVION, and VA are successful
- The promise of the conceived system which includes PGSS, DAVION, and VA is enormous, if the integration can be seamless. The OUE 14.2 exercise is significant to demonstrate the mentioned potential.

- Logistics was a success! The logistics went well. All pieces of PGSS gear arrived on trucks and were set in place by crane. The Inflation and aerostat set up went quickly which allowed for more time in setting up and testing the Common Operating Picture inside the GCS and on the mobile handheld devices. The Logistics team also did an outstanding job supplying the team with any equipment that was needed to include fuel for the two generators. Having fuel brought in daily was crucial to the success of the PGSS mission. The final day went as smooth as the inflation day. The aerostat was deflated in record time and the conexes were packed and ready for the trucks and crane to arrive and load all the equipment for transport. All the generators had the fuel ran off and ready for movement.
- Vignette 3, we can stream video to DAVION that is was lacking in XVM 14.1. Vignette 1 was also successful.
- The Oceus network seem to work seamlessly. As the WIFI network seemed to struggle, when the Oceus network had no distance or lagging issues.
- Deployment of the LTE payload and interoperability with the Singaporean applications was a major success from my perspective. Working together facilitated intercultural interaction.
- I would describe the soldier training as a big success. They seemed to grasp things very well. I think this showed our applications were fairly intuitive. I also got a lot of great feedback.
- Managing to showcase the applications during the mech assault
- DAVION applications were able to integrate the VA and PGSS video streams
- Integrating all of the technologies successfully
- Measure A-1-2-2 is also addressed in the previous section "Technology Integration"

SME Lessons Learned

Are there any lessons learned you will take away from this event regarding your technology, someone else's technology, or about the integration process?

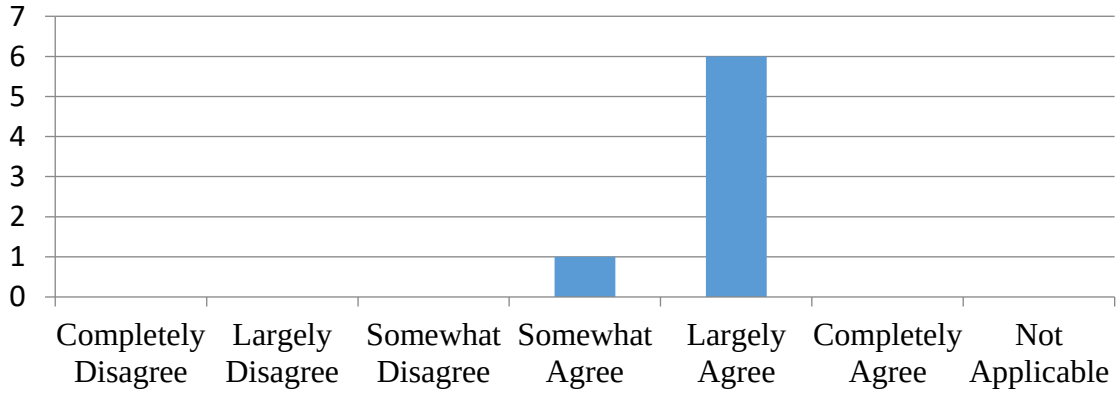
- The biggest lesson would be to take the time to learn and fully understand all technologies involved within the project to better integrate them into one system. I feel the demo went well and we worked through each problem effectively.
- There was configuration needed to use the LTE with the smart phones that shouldn't be. The configuration required *text not readable* software.
- Some technical aspects of the different technologies could have been discussed and agreed on beforehand to make the integration process as smooth as possible. Ex. The different URL video streams, the cameras' IP addresses
- Different people will have different ways of building their applications
- PGSS is quite interesting. I have an ideal to use PGSS to scan the area and automatically detect objects
- I think the lesson is that more TIME is needed when integrating foreign sensors and software into the already existing PGSS software suite. The more time allowed to test and evaluate the new technology the better. All bugs can be worked out and the system can be pushed to its limits prior to the actual event. There is nothing worse than trying to train people on software when it is not integrated properly Or hasn't been pushed to its limits

prior to handing the mobile devices. I've been on several of these missions and they are always cut short. I believe more time on the front end of the mission will pay dividends on the back end during the actual demonstration. Thank you for the opportunity to give my input.

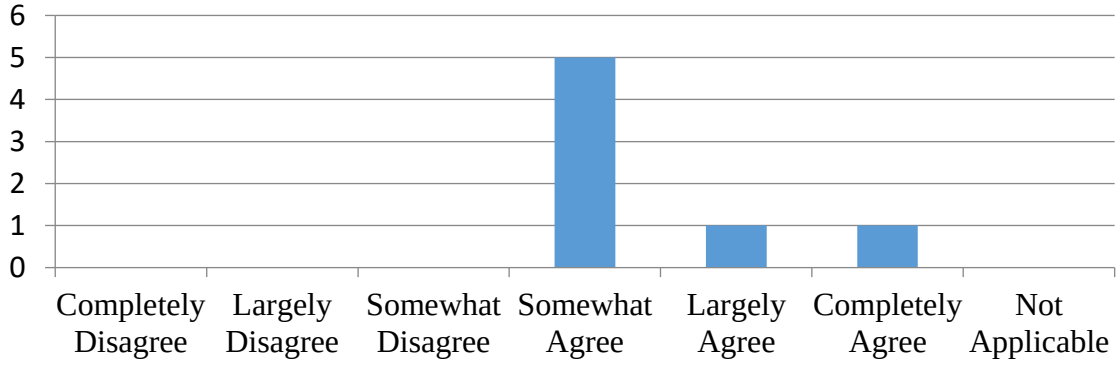
- Situational awareness is of the upmost importance for many military situations. Situational awareness through technology is an effective means, as long as the technology becomes robust, user-friendly, and accessible
- Streamline the workflows
- To communicate with other parties prior to test execution to resolve any outstanding issues.
- We learned to use android applications to ping the cameras, that improved camera setup efficiency
- More time for integration
- I think the vendors should have discussed their needs to other vendors prior to arrival so integration could run as smooth as possible.
- Mitigate schedule changes
- Minimize vignette amendments
- PGSS camera provides really good imagery
- Improve robustness to special conditions
- New tools to improve efficiency
- Got to have backup plans
- Bring all of the test equipment you have, even if you don't think you will need it
- This was not my first integration event so I am not surprised by much, nothing seemed out of the ordinary. I did get great feedback on potential improvements
- Frequency clearance should be addressed earlier in the planning phase for the PGSS LTE payload

Measure A-1-2-3: User Ratings the successful interoperability of the identified technologies
Measure A-1-2-4: The identified technology disseminated data as expected

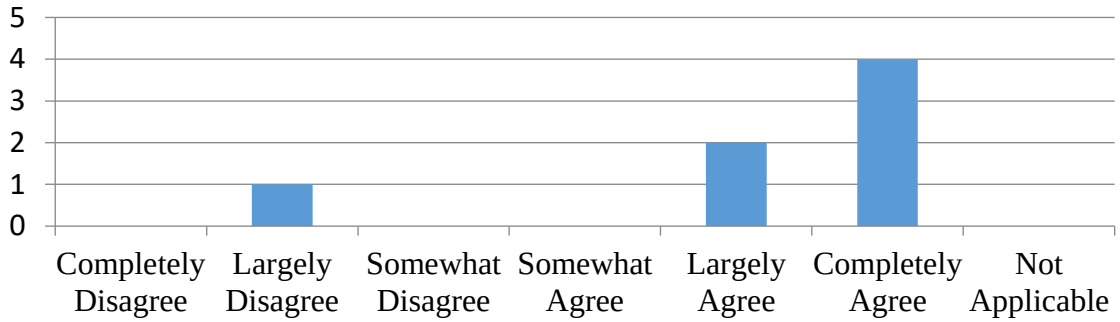
The DAVION Map application successfully disseminated, exchanged, and used information with the other OUE 14.2 technologies. (Users)



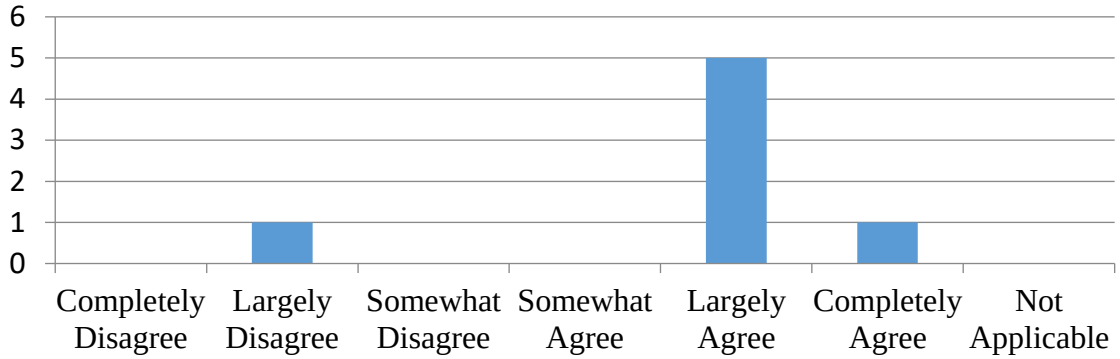
The DAVION Augmented Reality application successfully disseminated, exchanged, and used information with the other OUE 14.2 technologies. (Users)



The DAVION Chat application successfully disseminated, exchanged, and used information with the other OUE 14.2 technologies. (Users)



The DAVION WhiteBoarding application successfully disseminated, exchanged, and used information with the other OUE 14.2 technologies. (Users)



If any technologies were not ranked as Largely Agree or Completely Agree please provide comments to clarify your ranking (Users):

- The location of people and places was not very accurate
- Map did not update, not very accurate
- Augmented Reality worked but not very accurate

- The Augmented Reality should change the distance when we get closer so that we would know our location wasn't in the same spot as the pin-point pointed
- The Augmented Reality application is not really accurate. It is out of point of where things are pinned and requires adjusting to the location where we put it.
- The Augmented Reality wasn't on point and wasn't as accurate as it should be

Please provide feedback on the overall Interoperability of the OUE 14.2 technologies:

- Overall good if the three aps (Maps, Chat, and Whiteboarding) could be integrated into one app. It would save time not having to switch through apps.
- It was good except for the WiFi capabilities
- Overall it was good and just needs a little improvement
- It was good and easy to use. Just needs some improvement
- In theory, effective. In application, not very probable. WiFi capabilities are in and out, the apps are not interconnected so you constantly have to exit and re-enter apps, harder to share information quickly. Scenarios we practiced were scripted.
- Worked well when WiFi signal was strong. Lost signal a lot.
- The system was smooth
- Changing from app to another was easy and simple

Measure A-1-2-5: Determine the effective range of the identified technology

- Please see the 4G LTE Range Testing section

Measure A-1-2-6: Validate the PGSS telephone capability

- The PGSS telephone capability was validated during multiple vignettes. Calls were placed between networked phones, and to and from phones outside of the network.

DAVION AND PGSS USER TRAINING AND VIGNETTES

In order to provide Singaporean Guard and the U.S. Marine users exposure to the DAVION applications and PGSS Mobile Client the OUE team conducted training events for each group (Figures 24 and 25). Prior to training, each group was asked to complete a demographics form. The Singaporean Guards participated in training and practice vignettes on 11 December 2014. The users were divided into two groups, 2 DAVION and 3 PGSS users. The U.S. Marines were trained on 14 December 2014. 10 Marines were sent for training, but only 5 remained to participate in the practice vignettes and data collection efforts. The Marines were divided into two groups of 5, one for DAVION and one for PGSS. Each group was provided a verbal and visual demonstration of their respective technology by SMEs. During training users were encouraged to explore the capabilities of the technologies and ask any pertinent questions.

Figure 24: Singaporean Guards Receive Training on DAVION (Left) and PGSS (Right)

Figure 25: U.S. Marines Receive Training on DAVION (Left) and PGSS (Right)

Vignette 1

After training was completed users worked through a series of vignettes to help them gain exposure and familiarity with the technologies. Vignette 1 focused on a patrol scenario and

utilized the VA technology to alert users when the patrol deviated from the expected route. Vignette 1 was run with the DAVION applications and the PGSS Mobile Client separately with each user acting in each of the designated roles for the scenario (Figure 26). During the vignettes the users were able to provide feedback on the vignette so that adjustments could be made, when possible, to help add realism to the scenario. Due to the Singaporean Guard arriving two days early for training, the VA system was not yet functioning and the alerts were simulated.

Figure 26: Patrol Users Approach and Tag Suspicious Items as Part of Vignette 1 (Left) and Acting HQ/VCP Users Receive Intel on Suspicious Items

Vignette 1 OUE Data Collectors' Observations and User Feedback
As part of the data collection effort the data collectors recorded technology issues, changes to vignette 1, and user feedback during many of the training vignette runs. The data collected during each of those runs is provided below.

Vignette 1, 1st Run, PGSS (Singaporean Guards)

- Vignette was altered to include the GCS Chatting with the user and a user request for the GCS to zoom the camera after slewing
- Text feature did not work
- No video feeds were available (issue likely because of too many connections)
- Vignette was not completed because of a system failure
- **Feedback:** Old chats should be cleared before devices are given to new users. Users should have programed names instead of numbers that make it hard to identify the user

Vignette 1, 1st Run, PGSS (U.S. Marines)

- Aegon was not working on the devices, but was fixed once the power was cycled
- It took two full minutes before the tag showed up on the VCP device
- Feedback: The VCP user liked the capacity for this technology to help with recovery. The user does not receive an alert when there is an uploaded picture so unless they know something is coming they do not know to look for the information.

Vignette 1, 2nd Run, PGSS (Singaporean Guards)

- The VCP users added additional communication with the GCS for their situational awareness during the vignette
- Users were asked to use the Chat All feature so that all users had situational awareness
- **Feedback:** The Map has a limitation on zooming so pinning locations is not completely accurate. Switching between views was a bit annoying. Having all of the information in one view would be good.

Vignette 1, 2nd Run, PGSS (U.S. Marines)

- Had to make a 2nd attempt to slew the camera
- Server dropped. Vignettes were halted until the issue was resolved.

Vignette 1, 3rd Run, PGSS (Singaporean Guards)

- In spite of the accuracy of the pinning being slightly off due to zooming limitations, the VCP user was able to navigate to within eyesight of the patrol users using the recovery pin on the Map.
- The user attempted twice to slew the camera without success. The issue was identified as a problem caused due to the attempt to integrate the VA cameras while vignettes were being conducted. The PGSS camera was rebooted and the issue was resolved.
- **Feedback:** The screens are difficult to see in certain light due to the glare.

Vignette 1, 3rd Run, PGSS (U.S. Marines)

- Error sending tag/waypoint, the waypoint failed to save

Vignette 1, 1st Run, DAVION (Singaporean Guards)

- Blue Force tracking is slow to update
- User sent a pic using the Chat capability and tagged it on the Map
- The Blue Force tracking updated so slowly it could not be used to navigate
- **Feedback:** The WhiteBoarding app does not show the users position so it cannot be used to help navigate when making plans. The WhiteBoarding user should show up on the app.

Vignette 1, 1st Run, DAVION (U.S. Marines)

- VCP user notified patrol after they noted their recovery area in WhiteBoarding that he had changed the location
- The Blue Force Tracking appears to be updating more quickly than during Guard training
- Vignette stopped due to loss in Wi-Fi signal

Vignette 1, 2nd Run, DAVION (Singaporean Guards)

- The vignette was changed to have users use the Map tagging feature instead of WhiteBoarding because the VCP user could not navigate to the patrol using the WhiteBoarding app due to their position not showing up on the whiteboard. Both patrol users tagged the recovery location to see if that forced a refresh of the slow Blue Force locations. It did not force a refresh, one user still appeared on the other side of the street.

Vignette 1, 2nd Run, DAVION (U.S. Marines)

- All features worked during this run
- **Feedback:** All of the apps should be integrated into one app instead of the user having to switch between them

Vignette 1, 3rd Run, DAVION (Singaporean Guards)

- The user tagged the boxes, but because his GPS location was not updated the tagged position was not correct.
- The tags for the recovery location did not appear.
- Users sent the suspicious items information through Chat and Map feature
- Feedback: The lag makes it hard to determine if forces are Red or Blue. The blue and purple tag/pin colors are too close. It is difficult to distinguish between the two. Landmarks and Blue Force icons should not be so close.

Vignette 1, 3rd Run, DAVION (U.S. Marines)

- No alert received after route deviation.
- Photo sending lagged/was not received
- **Feedback:** Need to be able to zoom more closely. If there are multiple tags within a small area the user is not able to zoom close enough to click on the tag they want. The user should be able to tap on the alert and have the map open and indicate the alert location.

Vignette 2

Vignette 2 focused on a suspicious vehicle scenario and utilized the VA technology to alert users when the vehicle had a change in number of pax, and also when the passengers engaged in an altercation with VCP guards. Vignette 2 was run with the DAVION applications and the PGSS Mobile Client separately with each user acting in each of the designated roles for the scenario (Figure 27). During the vignette the users were able to provide feedback on the vignette so that adjustments could be made, when possible, to help add realism to the scenario. Due to the Singaporean Guard arriving two days early for training the VA system was not yet functioning so the alerts were simulated.

Figure 27: Patrol User Subdues Vehicle Passenger during Vignette 2 (Left) Patrol User Sends Images of Suspects (Center) and VCP User Receiving Updates (Right)

Vignette 2 OUE Data Collectors' Observations and User Feedback
As part of the data collection effort the data collectors recorded technology issues, changes to vignette 2, and user feedback during many of the training vignette runs. The data collected during each of those runs is provided below.

Vignette 2, 1st Run, PGSS (Singaporean Guards)

- Vignette altered to include the GCS sending a Chat to users indicating the area of the suspicious items
- The Chat lagged and photos at the vehicle location could not be sent
- The VCP user did not see Chats sent by the patrol because they sent to "super," Chat All should be used.
- **Feedback:** Chat should have names to help identify who you are sending to. Chat should have a copy and paste feature.

Vignette 2, 1st Run, PGSS (U.S. Marines)

- All features worked successfully

Vignette 2, 2nd Run, PGSS (Singaporean Guards)

- The login for some of the devices was not working. The users tried turning the Wi-Fi on and off. Ultimately the Aegon SME had to address the issue.
- The pin location was off again due to lack of zooming

Vignette 2, 2nd Run, PGSS (U.S. Marines)

- All features worked successfully

Vignette 2, 1st Run, DAVION (Singaporean Guards)

- The refresh was slow making it difficult to relocate the pin
- WhiteBoarding experienced a lag causing the patrol to have to wait for updating
- The VCP user lost connection and was logged out of the applications
- **Feedback:** The applications force the user to take a photo in order to pin something. Users thought this should not be required. Users suggested that a button be created that forces the applications to refresh.

Vignette 2, 1st Run, DAVION (U.S. Marines)

- VA alerts not operating
- **Feedback:** If something is tagged the users should get a ping to notify them

Vignette 2, 2nd Run, DAVION (Singaporean Guards)

- Pin did not work, all other actions good

Vignette 2, 2nd Run, DAVION (U.S. Marines)

- Wi-Fi dropped on all of the devices, all features were working as expected before the drop

Vignette 3

The focus of Vignette 3 was to provide users with exposure to potential uses of PGSS, VA, and DAVION technologies within a mechanized assault scenario. Users were asked to work through the vignettes on their own to try to gain familiarity with the applications within the provided context. The users were provided an attacker and a defender scenario. In place of specific data being collected during Vignette 3 runs, users were asked to provide comments on their use of the technologies during the actual mechanized assault as part of the final user survey.

User Comments:

- During the assault on PDL Combat Town we were able to communicate and pass info about where the enemy was, mooring, and deploying using the Chat capabilities and camera feeds. By using the cameras and Chat apps we were able to employ surprise against the enemy because we didn't have to poke out heads out to see where they were, and give away our position. However, once we were engaged, due to the fact that the apps were not interconnected, it would take too much time to use the apps effectively while engaging the enemy. If the apps were interconnected we could have continued to track the enemy movements to better engage them.
- For the attack I was the eyes in the sky. So when the enemy was near I was watching on the monitors and was allowed to communicate using the Chat application. I let my team know when the enemy was near the building, how they were moving, and how many were moving up to the building. If it's possible to get a greater wireless connection it would make this program way more efficient in a battle area.

DV Day Vignette

The DV Day vignette was rehearsed on the previous day and the morning of the actual demonstration. The DAVION and PGSS teams were integrated to provide visitors with a demonstration that incorporated all of the participating technologies (Figure 28). To help provide users with an engaging demonstration monitors were setup in the demonstration area to provide the visitors an on screen display of the PGSS GCS aerial view, the HQ/VCP Users DAVION handset, and the HQ/VCP users PGSS handset. No additional data was collected during the demonstration, but all technologies worked as expected resulting in a very successful demonstration.

Figure 28: DV Day, HQ Users at Mobile COP (Left) Patrol Team Receiving Orders (Center) and Combined User Team Subduing Suspects during DV Day Rehearsal (Right)

DAVION ASSESSMENT RESULTS

This section provides details on the functional areas, objectives, and measures used to collect data on the DAVION suite of applications. It also includes the survey feedback collected during the event.

DAVION Applications Functional Areas, Objectives, and Measures

This section identifies the measures used to collect data on the suitability of the DAVION Applications during OUE 14.2. The TEC assessment team addressed the measures using the data sources identified in the following tables. All results are supported by observations and user comments when available.

Functional Area B-1: Suitability
Are the DAVION Applications suitable for supporting operations in urban environments?

Objective B-1.1: Assess Usability
This objectives seeks to assess the usability of the identified technologies. In this context usability is includes the overall look and feel, video quality, and timeliness of data.

Table 18: Objective B-1.1 Data Matrix

Measure	Source	Product
Objective B-1.1: Assess Usability		
Measure B-1-1-1: User rating of the video quality of the identified technology	Interview, Questionnaire	Table, Text
Measure B-1-1-2: User rating of the timeliness of data received/sent using the identified technology	Interview, Questionnaire	Table, Text
Measure B-1-1-3: User rating of the overall look and feel of the user interface of the identified technology	Interview, Questionnaire	Text, Bar Chart

Objective B-1.2: Assess Reliability
This objectives seeks to assess the reliability of the identified technologies. In this context reliability includes ability of the technology to perform tasks without losing functionality, ability of the identified technology to provide accurate information, and the user rating of the overall reliability of the identified technology.

Table 19: Objective B-1.2 Data Matrix

Measure	Source	Product
Objective B-1.2: Assess Reliability		
Measure B-1-1-1: Number and type of reliability issues for the identified technology	Interview, Questionnaire Event Logs	Table, Text
Measure B-1-1-2: User rating of the accuracy of the data provided by the identified technology	Interview, Questionnaire	Table, Text
Measure B-1-1-3: User rating of the overall reliability of the identified technology	Interview, Questionnaire	Text, Bar Chart

Objective B-1.3: Assess Training
This objectives seeks to assess the effectiveness of the training provided for each of the identified technologies. Training will include classroom instruction as well as hands-on experience with the system.

Table 20: Objective B-1.3 Data Matrix

Measure	Source	Product
Objective B-1.3: Assess Training		
Measure B-1-3-1: Time required to train users	Event Log	Table
Measure B-1-3-2: User rating of classroom training	Questionnaire, Interviews	Bar Chart, Text
Measure B-1-3-3: User rating of training documents	Questionnaire, Interviews	Bar Chart, Text

Functional Area B-2: Mission Impact
Do the DAVION Applications have a positive impact on mission accomplishment?

Objective B-2.1: Assess Impact on Situational Awareness
This objectives seeks to assess the impact of the identified technologies on situational awareness. In this context a positive impact on situational awareness is defined as providing the user valuable information that will help accomplish the mission without negatively hindering that mission.
Data collectors will conduct interviews and/or surveys will be utilized to collect subjective data from users.

Table 21: Objective B-2.1 Data Matrix

Measure	Source	Product
Objective B-2.1: Assess Impact on Situational Awareness		
Measure B-1-1-1: User rating of the impact of the identified technology on improving situational awareness	Interview, Questionnaire	Table, Text, Bar Chart
Measure B-1-1-2: User rating of the impact of the overall usefulness of the identified technology	Interview, Questionnaire	Table, Text, Bar Chart

Objective B-2.2: Assess Impact on Decision Making
This objectives seeks to assess the impact of the identified technologies on decision making. In this context a positive impact on decision making is defined as providing the user valuable information that will help the user make decisions important to accomplishing the mission.

Table 22: Objective B-2.2 Data Matrix

Measure	Source	Product
Objective B-2.2: Assess Impact on Decision Making		
Measure B-2-2-1: User rating of the impact of the identified technology on improving decision making	Interview, Questionnaire	Table, Text, Bar Chart

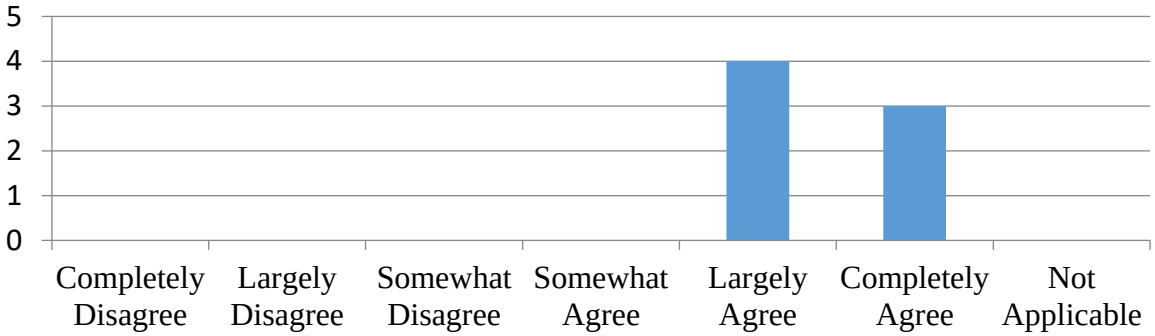
Davion Survey Results

This section provides the DAVION survey feedback collected from participating users during the OUE 14.2 technology integration event.

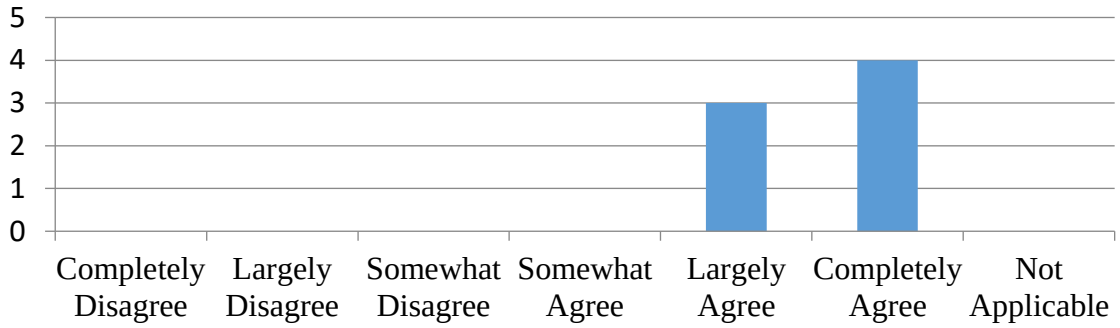
Functional Area B-1: Suitability

Measure B-1-1-1: User rating of the video quality of the identified technology

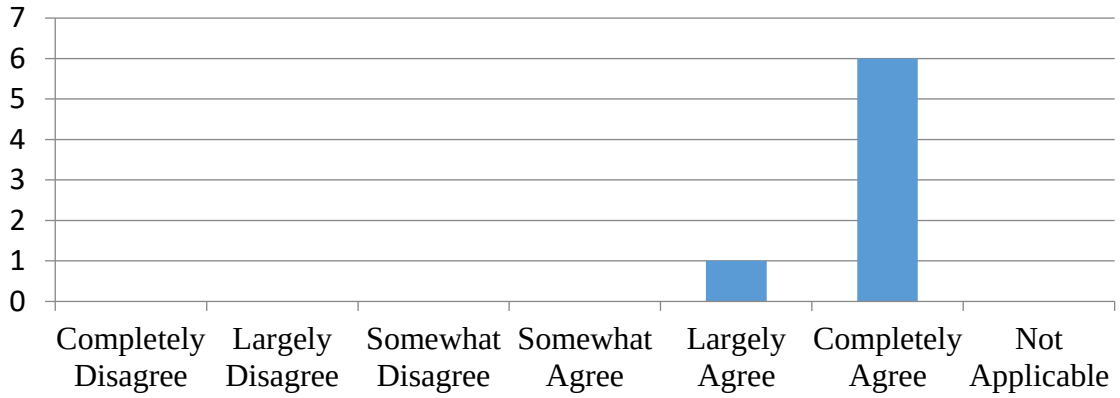
The Video quality of the DAVION Map capability was good.



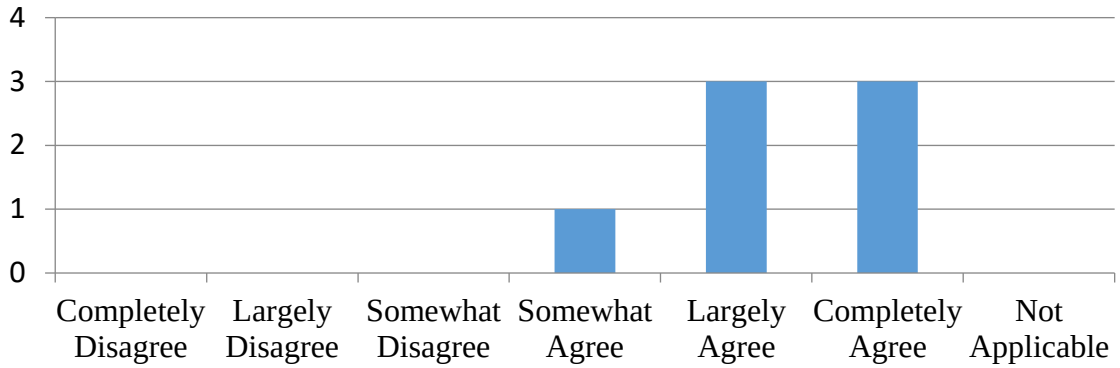
The Video/photo quality of the DAVION Augmented Reality capability was good.



The display quality of the DAVION Chat capability was good.



The display quality of the DAVION WhiteBoarding capability was good.

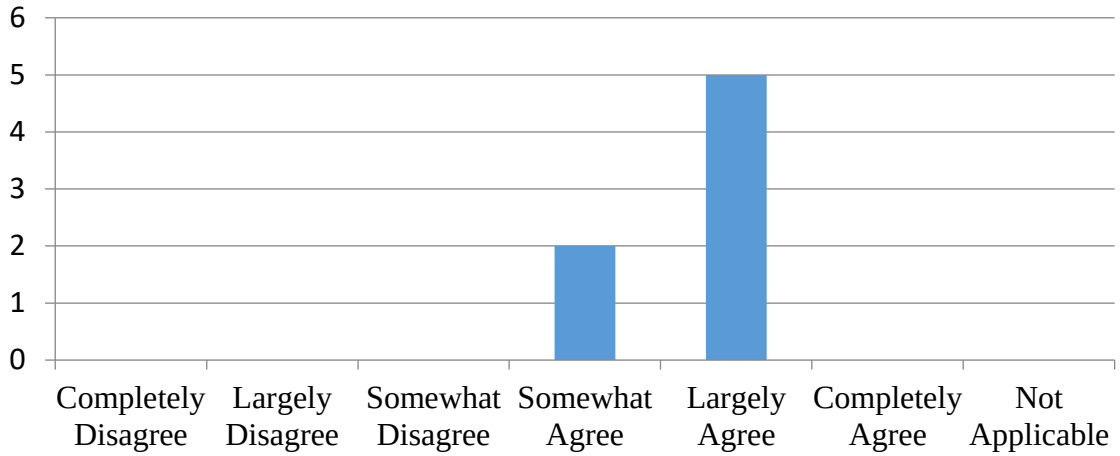


If any technologies were not ranked as Largely Agree or Completely Agree in relation to Video Quality please provide comments to clarify your ranking:

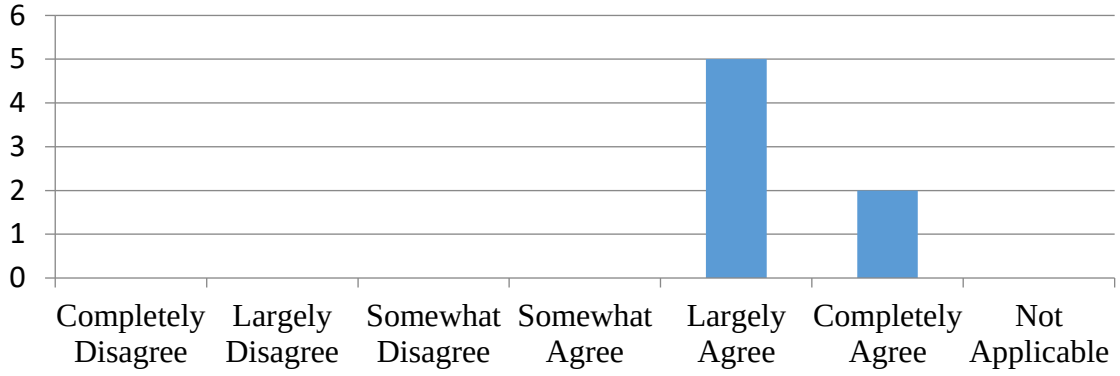
- The video quality could be better, maybe HD
- Photo quality was good
- DAVION chat was simple and easy to use
- The WhiteBoarding can be improved. Due to size of user's fingers, and not being able to zoom in on the map, at times drawing is not accurate.

Measure B-1-1-2: User rating of the timeliness of data received/sent using the identified technology

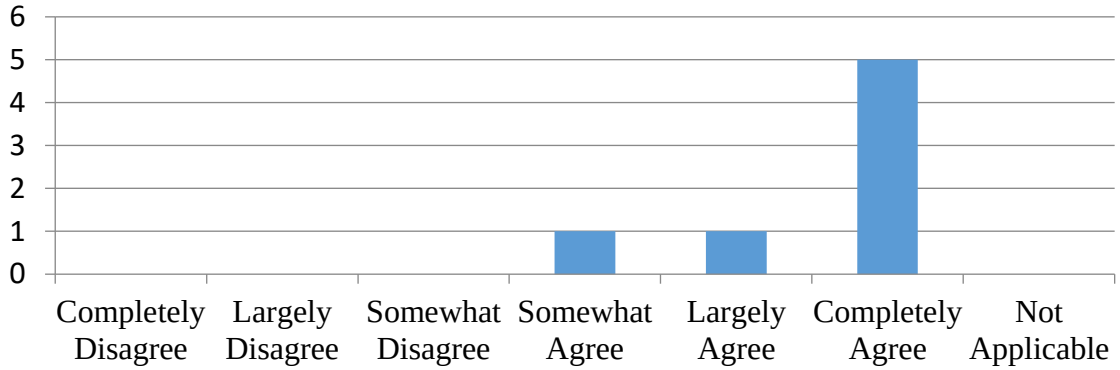
The time required to send and/or receive data using the DAVION Map capability was acceptable.



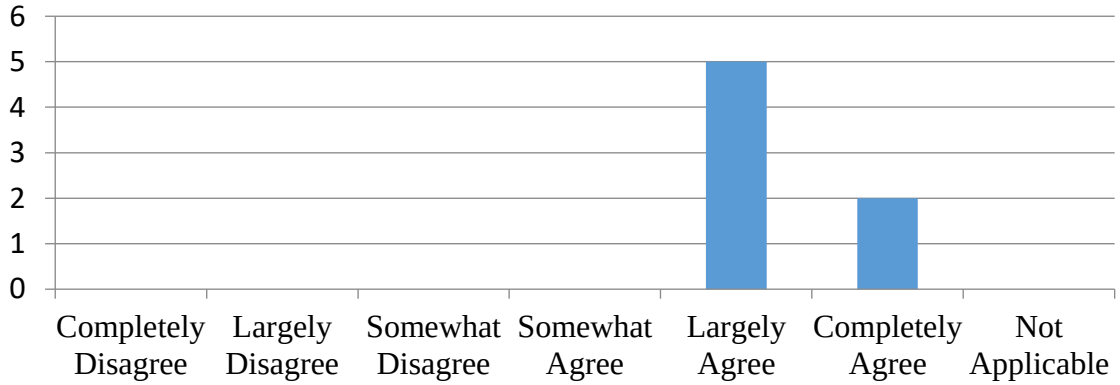
The time required to send and/or receive data using the DAVION Augmented Reality capability was acceptable.



The time required to send and/or receive data using the DAVION Chat capability was acceptable.



The time required to send and/or receive data using the DAVION WhiteBoarding capability was adequate.



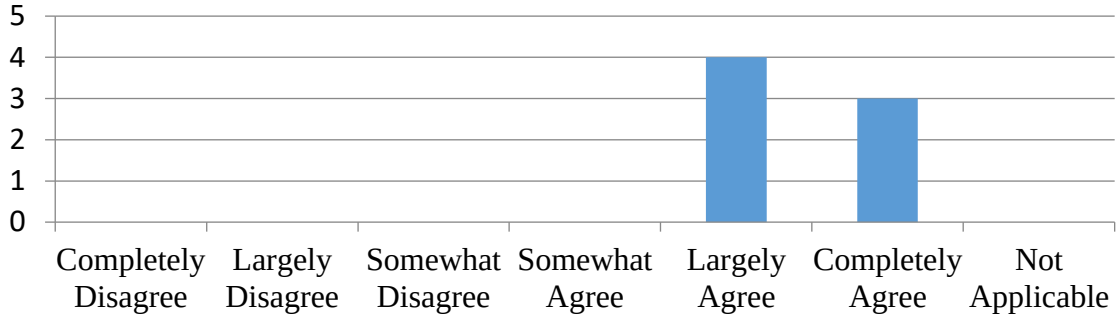
If any technologies were not ranked as Largely Agree or Completely Agree in relation to Timeliness please provide comments to clarify your ranking:

- At times the reality capability detection would be late/lag
- The Chat capability was almost instantaneous

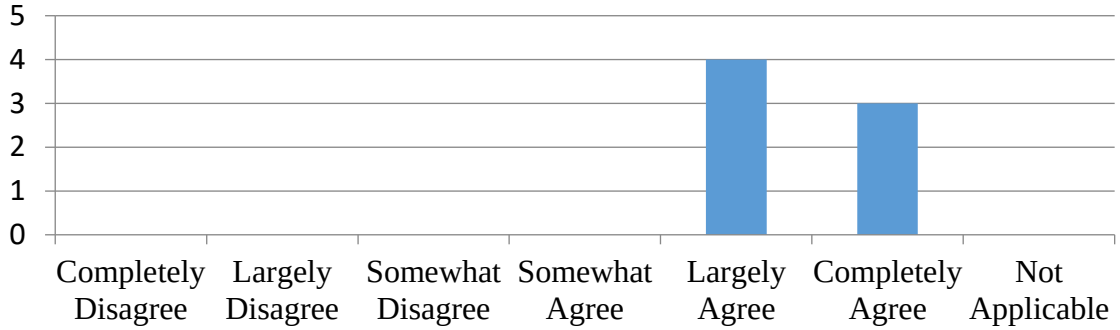
- WiFi was unreliable, makes it hard to send text/pictures
- There was a delay in video feed and in aggression alerts
- DAVION Map would take some time to show blue forces moving
- The accuracy of the location pin improved during the event and is a lot faster
- The Map took a while to refresh and keep me updated on pins and other points on the map

Measure B-1-1-3: User rating of the overall look and feel of the user interface of the identified technology

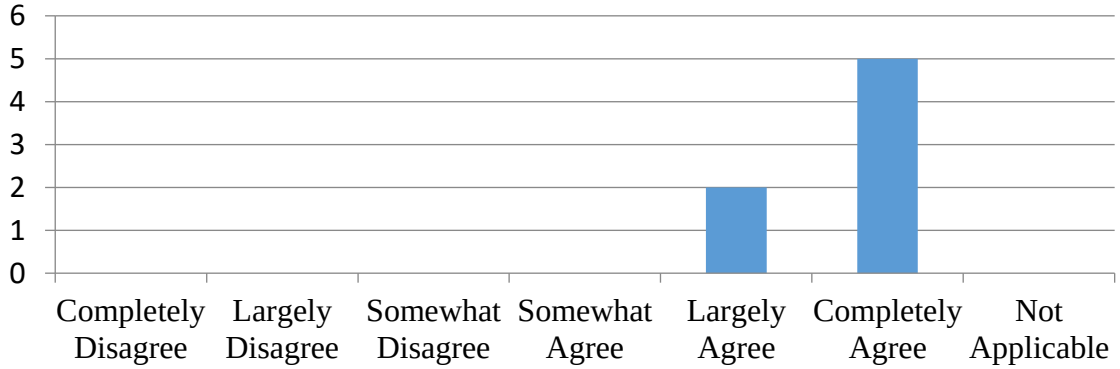
The overall Look and Feel of the DAVION Map capability was good.



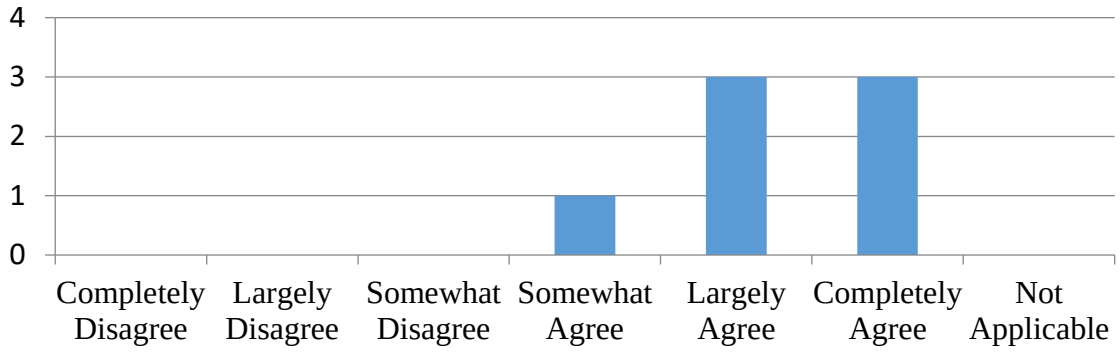
The overall Look and Feel of the DAVION Augmented Reality capability was good.



The overall Look and Feel of the DAVION Chat capability was good.



The overall Look and Feel of the DAVION WhiteBoarding capability was good.



If any technologies were not ranked as Largely Agree or Completely Agree in relation to Look and Feel please provide comments to clarify your ranking:

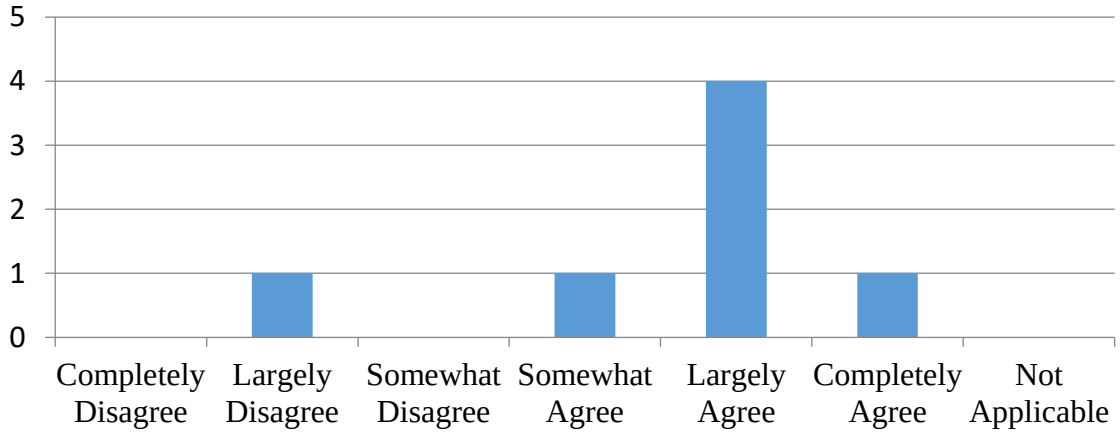
- Simple and user friendly
- Sometimes it didn't update, the whiteboard looks sloppy

Measure B-1-1-1: Number and type of reliability issues for the identified technology

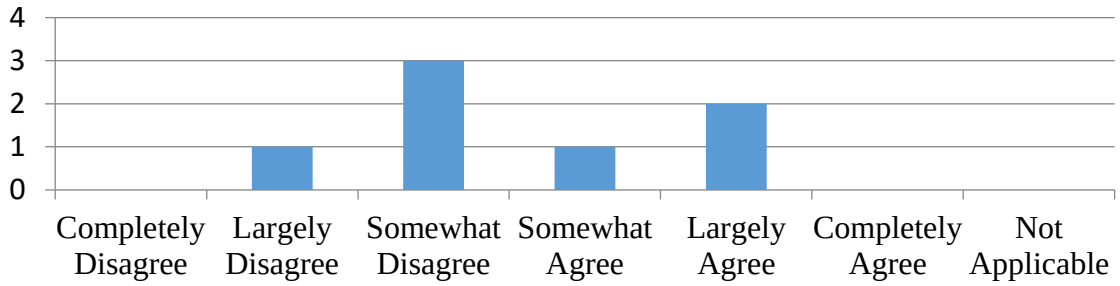
- Various reliability issues were logged during the integration of the technologies. Issues were also logged during training and vignettes. The number and type of each were not logged as the majority of issues were tied to the dropping of the Wi-Fi signal. The PGSS Mobile Client also crashed a couple of times during the event. The VA system also encountered some issues due to integration problem and a shorted timeline for training the software. Additional details can be found in the "Technology Integration" section of the report.

Measure B-1-1-2: User rating of the accuracy of the data provided by the identified technology

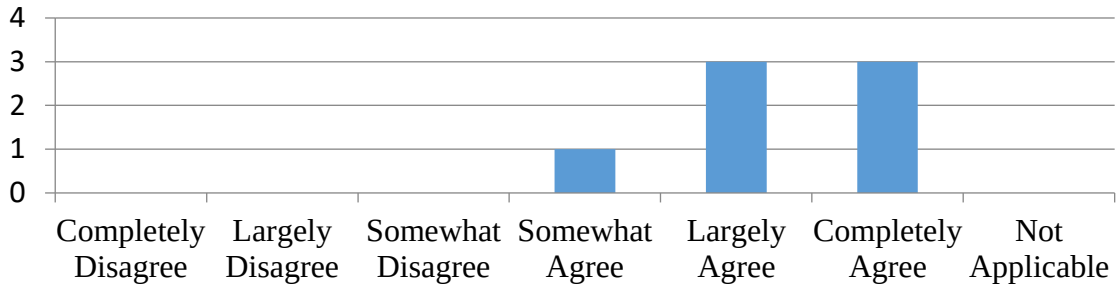
The Accuracy of the DAVION Map capability was good.



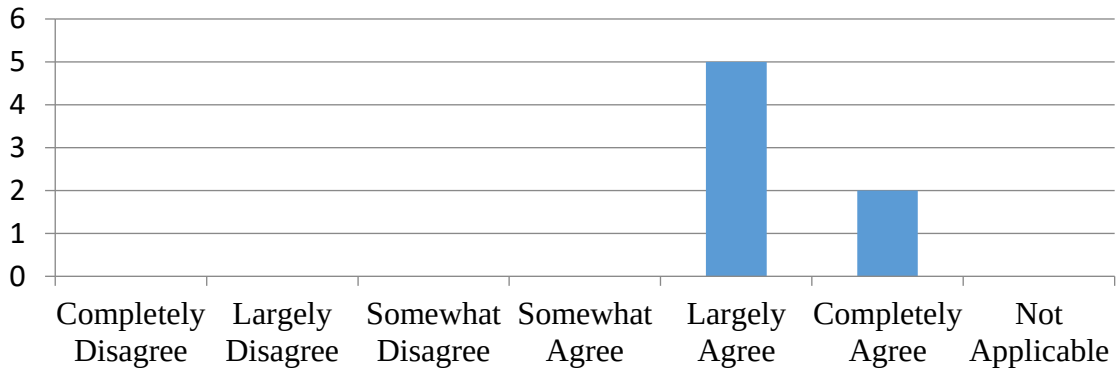
The Accuracy of the DAVION Augmented Reality capability data was good.



The Accuracy of the DAVION Chat capability data was good.



The Accuracy of the DAVION WhiteBoarding capability data was good.



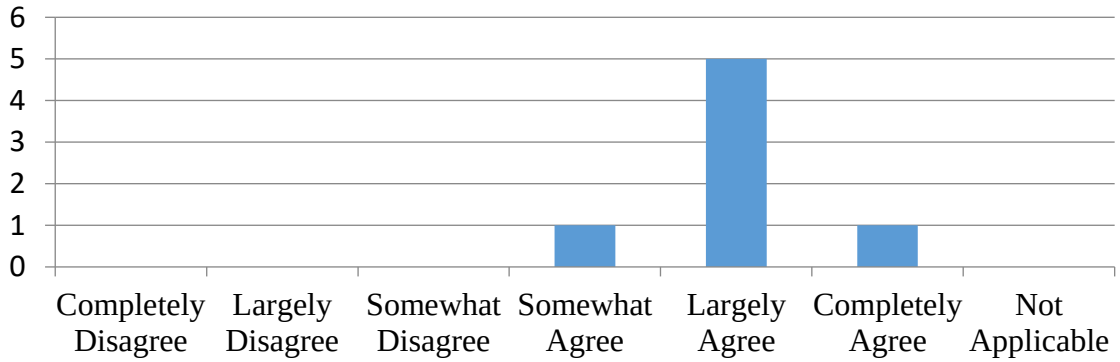
If any technologies were not ranked as Largely Agree or Completely Agree in relation to Accuracy please provide comments to clarify your ranking:

- Trying to see the points that were meant to be right on a specific item or area was off by a lot
- The DAVION Map accuracy is quite slow updating, even when it refreshes
- The Augmented Reality was bad, it linked to another location
- The DAVION has improved, since starting the event, based on the convenience of chatting from location to location and it's good to use the Chat application to make things easier and clearer instead of using the comms because at times there might be distortion of voice and you can't pass the message clearly
- The DAVION Augmented Reality was not that good. Sometimes it would appear all around and not to the place we pinned

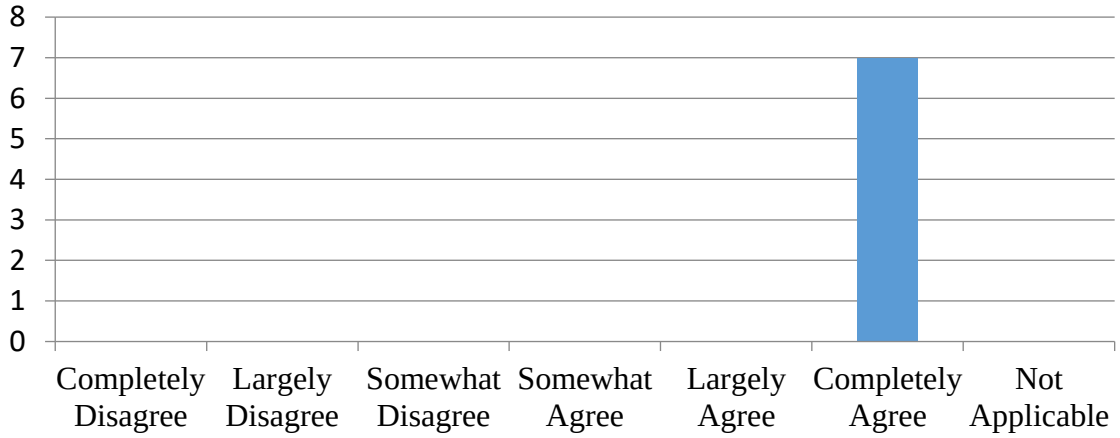
- The Map is not accurate, places like friendly locations were off by 100 meters, if it event updated. Half of the time the information was not up to date on the friendly location. Augmented Reality was also not accurate to the exact locations of the pins. Great if looking for a city, bad if looking for a person or suspected IED. Chat worked as long as WiFi worked
- Augmented Reality was not accurate
- At times the accuracy of the Map would lag when blue forces were moving

Measure B-1-1-3: User rating of the overall reliability of the identified technology

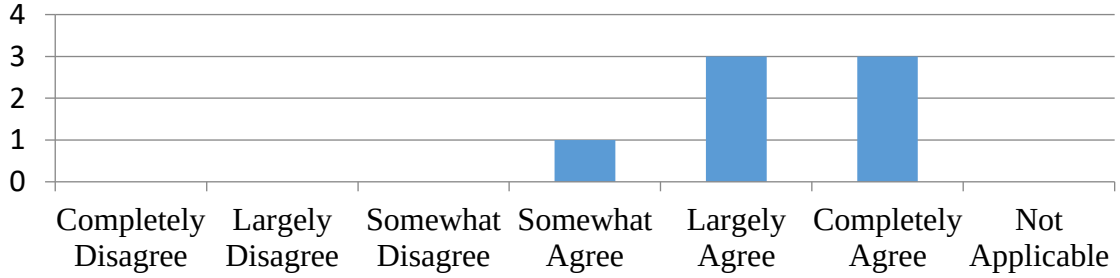
The overall Reliability (functioned as expected without crashing) of the DAVION Map capability was good.



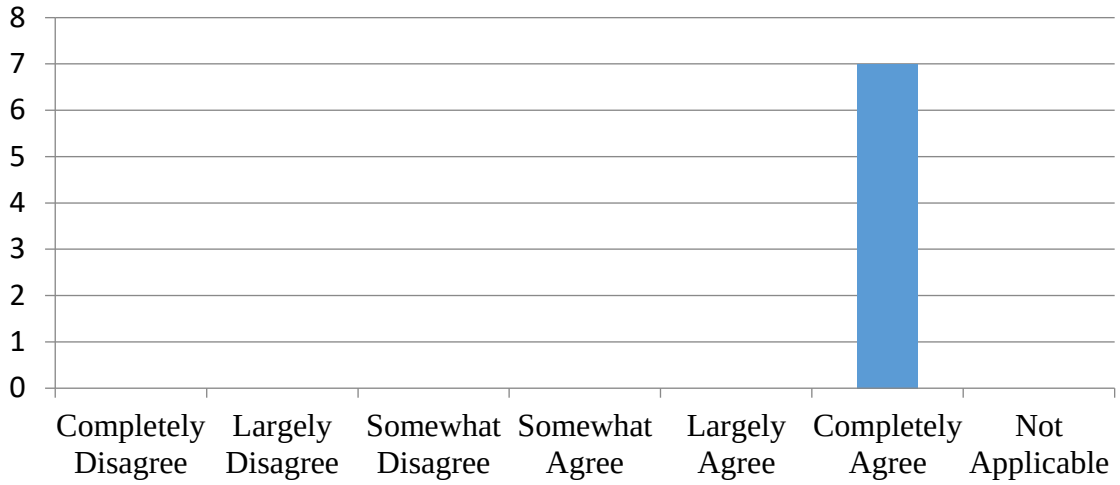
The overall Reliability of the DAVION Augmented Reality capability was good.



The overall Reliability of the DAVION Chat capability was good.



The overall Reliability of the DAVION WhiteBoarding capability was good.



If any technologies were not ranked as Largely Agree or Completely Agree in relation to Accuracy please provide comments to clarify your ranking:

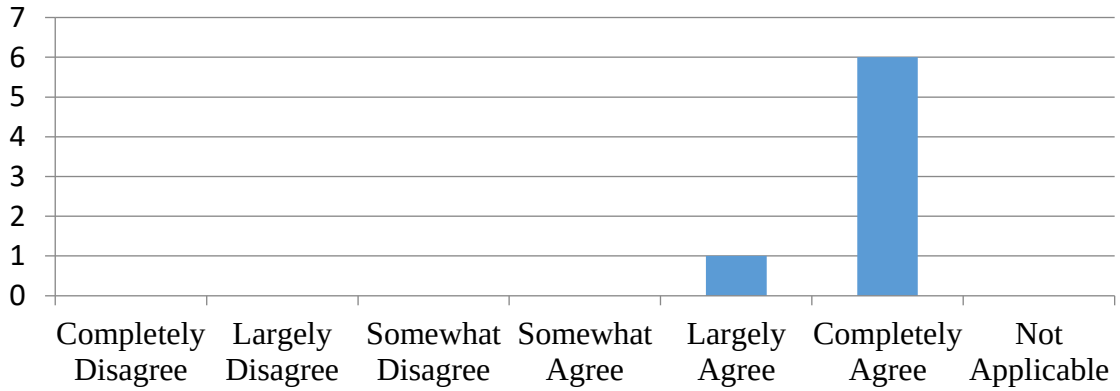
- WiFi crashed often, which effected Chat and Maps
- Delayed updates for aggression detection

Measure B-1-3-1: Time required to train users

- Verbal training session was conducted in less than 1 hour. Often the users picked up on the applications within a few minutes and used the remaining time to ask questions and explore the technology.

Measure B-1-3-2: User rating of classroom and hands-on training

The classroom and hands-on training provided for the DAVION applications was good.



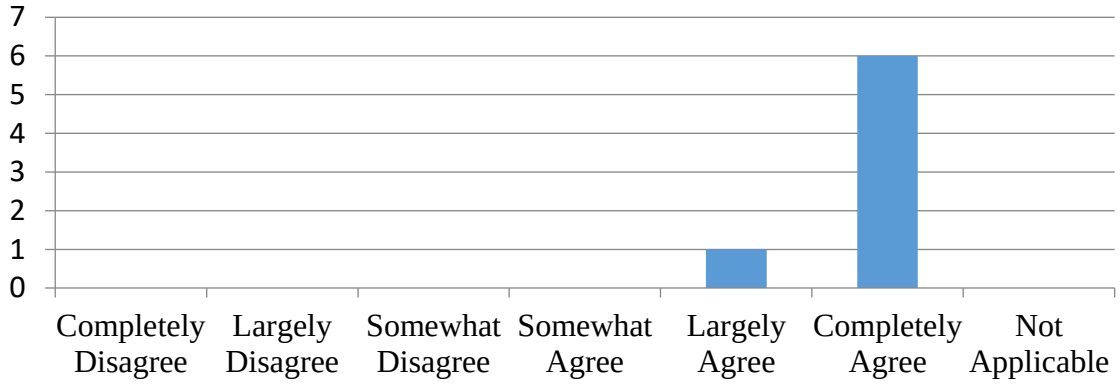
How would you suggest training be improved for any or all of the applications you used during OUE 14.2?

- If would be great if the user could confirm that an Chat message had been received, like with WhatsApp

- Use more real world situations to test the gear and how well it will function
- More realistic training scenarios, better WiFi capabilities
- Training and the teaching of using the apps was good
- More realistic scenarios, and try to have everything up and working to help the training feel more real
- The scenarios, though realistic in nature, are not applied in a realistic way

Measure B-1-3-4: User rating of training documents

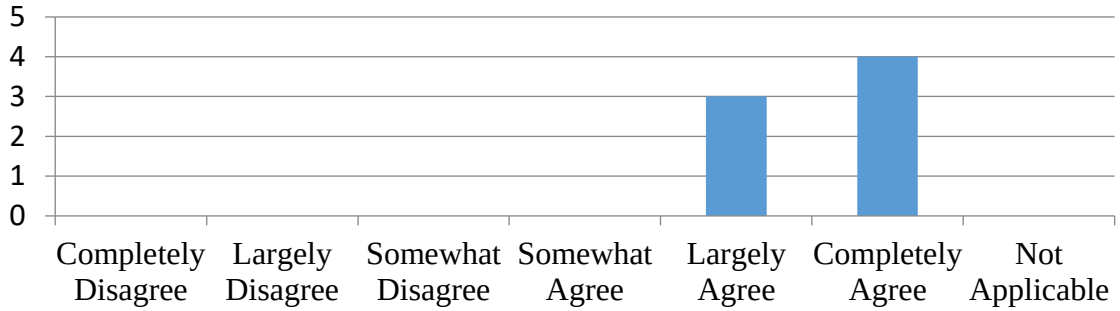
The training documents/presentations provided for the DAVION applications were helpful.



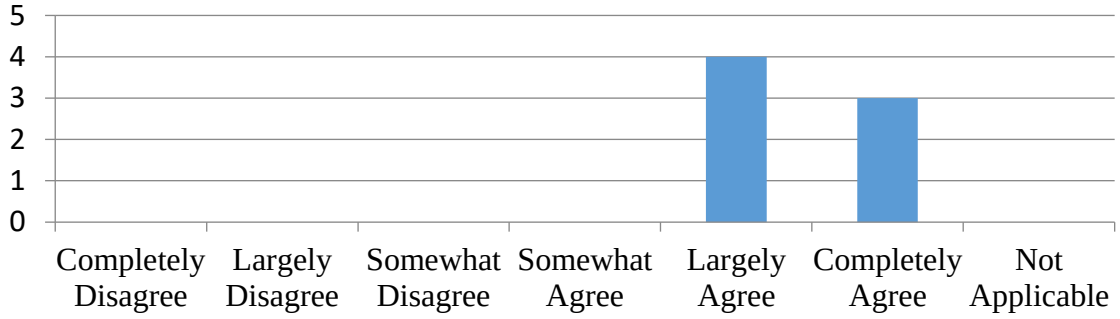
Functional Area B-2: Mission Impact

Measure B-1-1-1: User rating of the impact of the identified technology on improving situational awareness

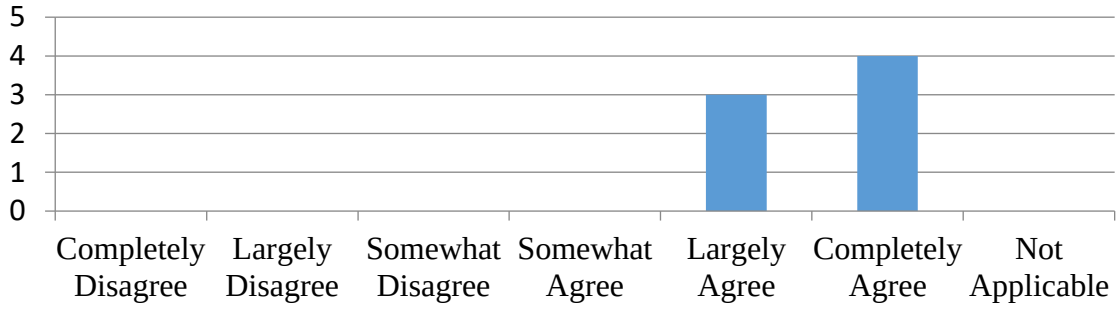
The DAVION Map capability had/would have a positive impact on situational awareness.



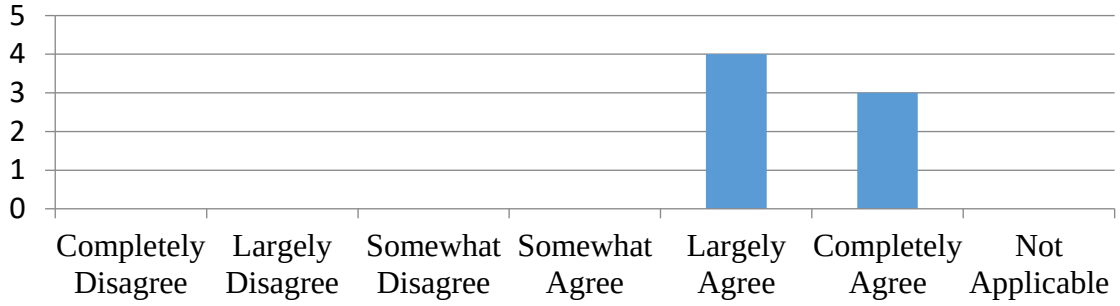
The DAVION Augmented Reality capability had/would have a positive impact on situational awareness.



The DAVION Chat capability had/would have a positive impact on situational awareness.



The DAVION WhiteBoarding capability had/would have a positive impact on situational awareness.

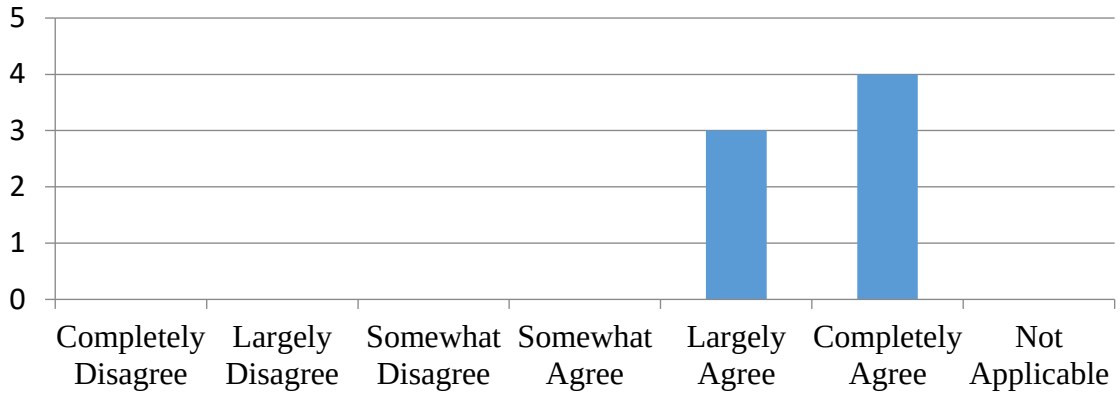


If any technologies were not ranked as Largely Agree or Completely Agree in relation to Situational Awareness please provide comments to clarify your ranking.

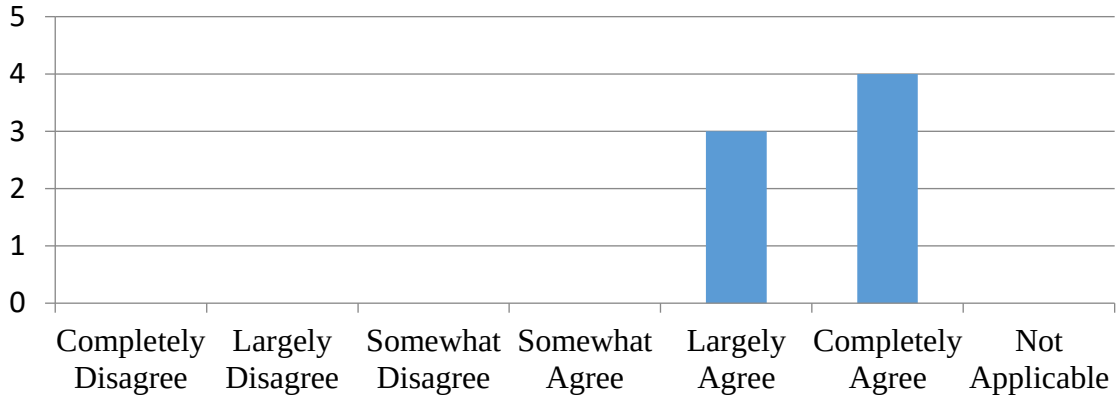
- Information sent though Chat, i.e. pictures, was good
- The user will have a better understanding of what is happening during operations

Measure B-1-1-2: User rating of the impact of the overall usefulness of the identified technology in urban environments

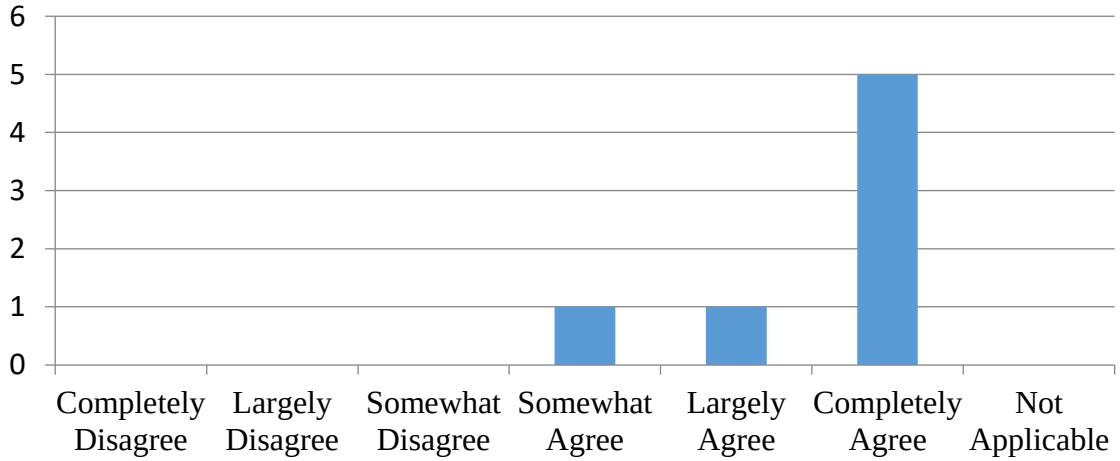
The DAVION Map capability would be useful in urban environments



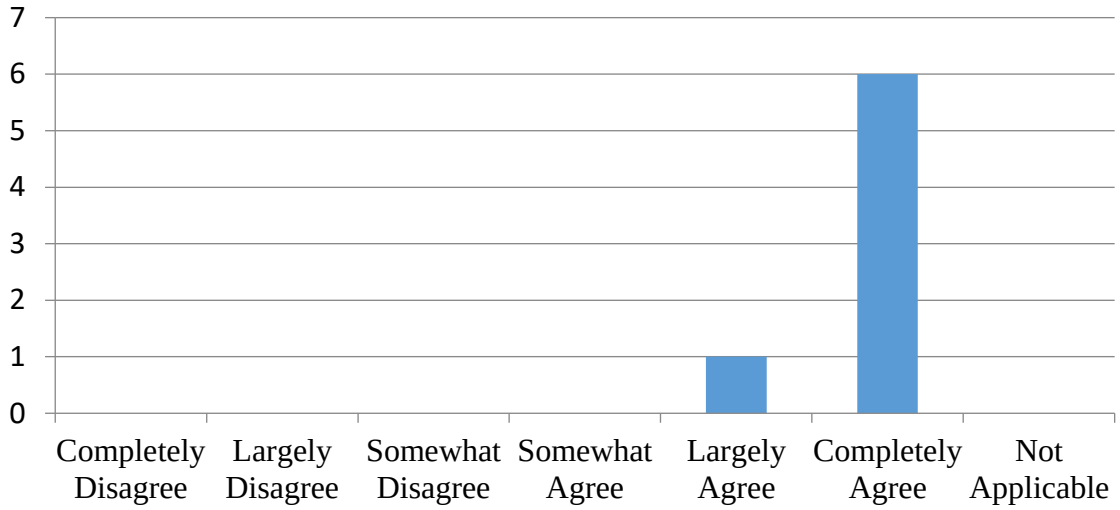
The DAVION Augmented Reality capability would be useful in urban environments



The DAVION Chat capability would be useful in urban environments



The DAVION WhiteBoarding capability would be useful in urban environments

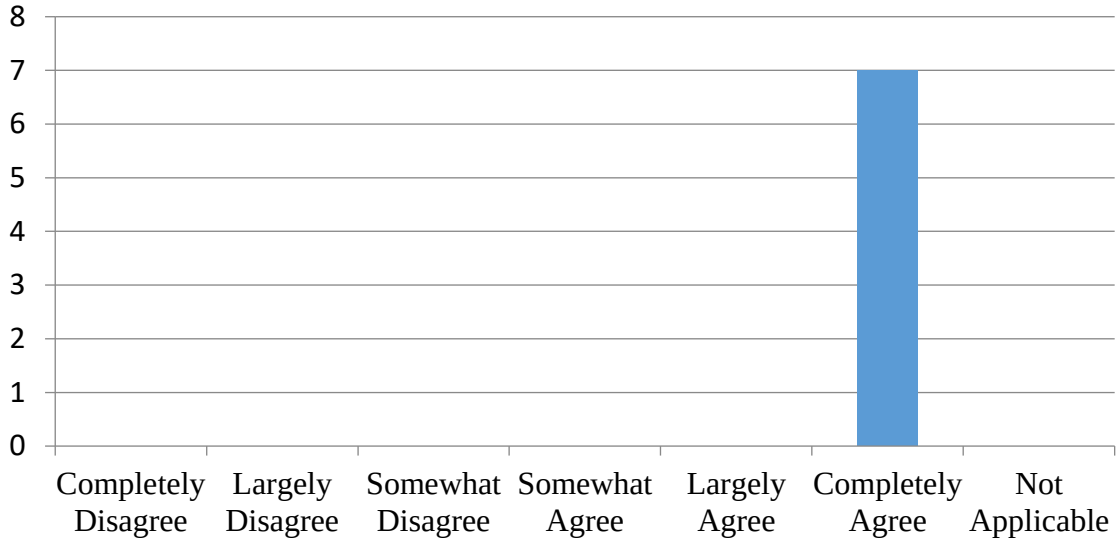


If any technologies were not ranked as Largely Agree or Completely Agree in relation to operating in urban environments please provide comments to clarify your ranking.

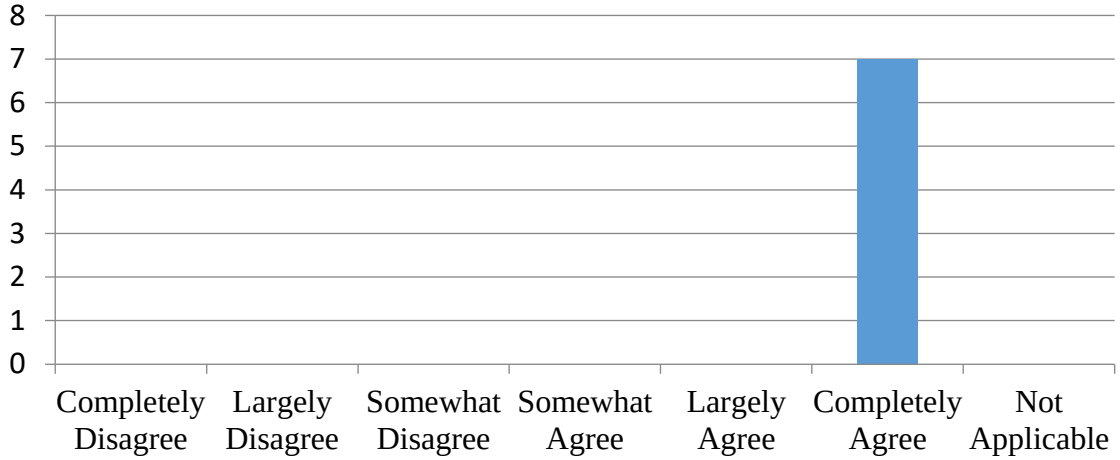
- It would be simpler to radio in unless we needed to remain clandestine then it could be a better choice

Measure B-2-2-1: User rating of the impact of the identified technology on improving decision making

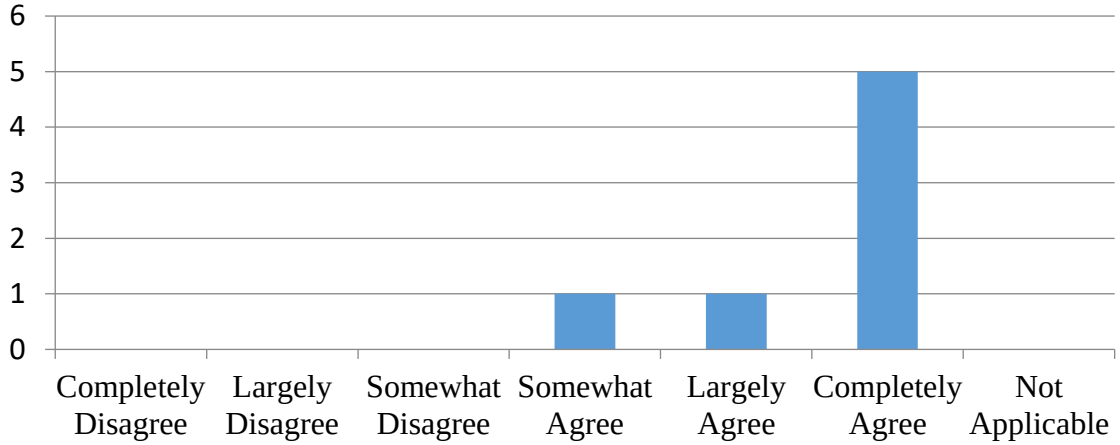
The DAVION Map capability would provide valuable information to help the user make decisions important to accomplishing missions.



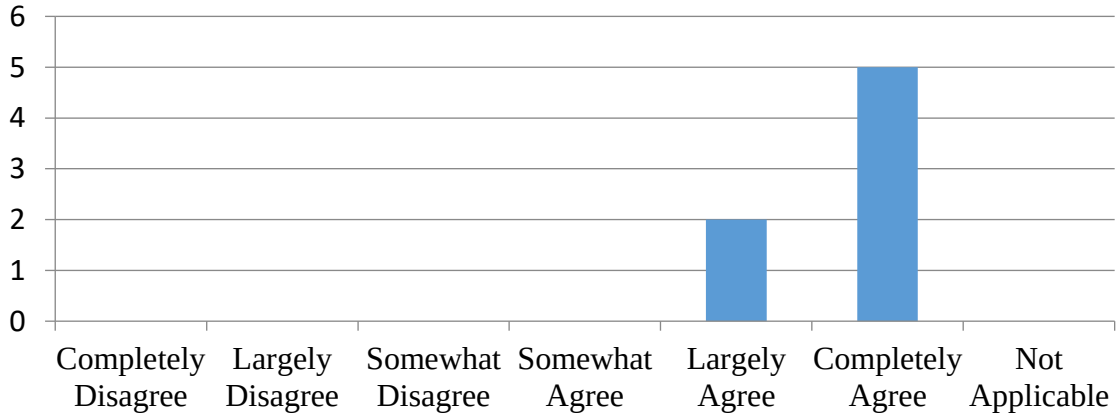
The DAVION Augmented Reality capability would provide valuable information to help the user make decisions important to accomplishing missions.



The DAVION Chat capability would provide valuable information to help the user make decisions important to accomplishing missions.



The DAVION WhiteBoarding capability would provide valuable information to help the user make decisions important to accomplishing missions.



If any technologies were not ranked as Largely Agree or Completely Agree in relation to Decision Making please provide comments to clarify your ranking.

- The blue force tracking would help the commander monitor the position of his troops, but time accuracy must be improved
- Should have a stylus for whiteboarding for better accuracy
- When it comes to passing information we already have radio communications we can use. If we needed to remain clandestine chat wouldn't be a better choice, however, if on a patrol it would be better just to radio in versus trying to send text

Additional Survey Questions

Would the DAVION applications be a valuable tool in HADR environments? Explain.

- Position of troops
- Quick information on sighted riots or "change of baseline"
- Yes, it would help organize and give better situational awareness to anyone using it and could help make better decisions
- Yes, the ability to see mission tasks of multiple squads, and gain better situational awareness will allow commanders to make real time decisions.
- Pax detection and aggression alerts provide more safety, SA, and security for marines especially in a MOUT environment
- DAVION applications would be valuable when we can't do our radio chat in some places or we need to be quiet in some places, we would markout the place and use chat
- Yes, it would be useful as a just in case if comms or radio were down. We could use the Chat application to communicate our whereabouts to another person at another location and pin our location and markout where we are at
- Yes it will, because if needed to more people or personnel from one spot to another both Map and Whiteboarding would work for that
- Yes, we could drop pins in areas in need of certain supplies and also use the pins to categorize certain areas, i.e. critical, urgent, stable, etc.

Are there any other environments where any or all of the PGSS Mobile COP applications would be valuable?

- In any landscape environment where there could be possible IEDs the AR funcation would be very helpful in alerting other united of possible IED location
- Yes, any environment would be great to use the DAVION technology
- It would be good during conventional ops as it would be wasier to communicate instead of using the comms at all times
- Detecting enemy and blue forces in the area
- It's good for conventional so that we can mark out the enemy harboring area and using the Whiteboarding app to send it to everybody so we know how we are going to attack the enemy
- MOUT environments would benefit most from DAVION applications due to the requirement for WiFi connection. The DAVION would not be of great use in other environments
- Yes, it could be useful in any environment

- Conventional (jungle), Live Firing (company/platoon)

Are there any changes you would make to any of the DAVION applications?

- Blue tracks like those they have in WhatsApp
- A more powerful WiFi network
- Major upgrade to the WiFi and make the 3 apps interconnected to allow easier and quicker access and passing on information
- Improve the Whiteboarding app, if others are making changes to the Whiteboard send an alert so the users knows
- Better range on the Chat, because sometimes it will not receive or send out if the distance is pretty far apart. And it does automatic logout when not in use after a while which causes miscommunications. This will delay the mission.
- Try to combine Map and Whiteboarding to one app, would make it faster to use and less of a hassle
- Better WiFi connection
- Make the 3 apps into a single app

Are there any additional applications that would add value to the DAVION applications package?

- Hands free communication, Bluetooth
- Adding a voice recorder button just in case if there is an IED spotted and the person might be too nervous to react and type they can press the record button and report what they have seen, it would be much easier
- Maybe a reinforcement button for when there is a need for urgency, so we don't need to type
- Bluetooth headset capability, some sort of hands free communication
- Bluetooth headset cability
- Aerial surveillance to over view the objective/area of ops

PGSS MOBILE CLIENT ASSESSMENT RESULTS

This section provides details on the functional areas, objectives, measures used to collect data on the PGSS Mobile Client. It also includes the survey feedback collected during the event.

PGSS Mobile Client Functional Areas, Objectives, and Measures

This section identifies the measures used to collect data on the suitability of the PGSS Mobile Client during OUE 14.2. The TEC assessment team addressed the measures using the data sources identified in the following tables. All results are supported by observations and user comments when available.

Functional Area B-1: Suitability
Are the PGSS Mobile Client suitable for supporting operations in urban environments?

Objective B-1.1: Assess Usability
This objectives seeks to assess the usability of the identified technologies. In this context usability is includes the overall look and feel, video quality, and timeliness of data.

Table 23: Objective B-1.1 Data Matrix

Measure	Source	Product
Objective B-1.1: Assess Usability		
Measure B-1-1-1: User rating of the video quality of the identified technology	Interview, Questionnaire	Table, Text
Measure B-1-1-2: User rating of the timeliness of data received/sent using the identified technology	Interview, Questionnaire	Table, Text
Measure B-1-1-3: User rating of the overall look and feel of the user interface of the identified technology	Interview, Questionnaire	Text, Bar Chart

Objective B-1.2: Assess Reliability
This objectives seeks to assess the reliability of the identified technologies. In this context reliability includes ability of the technology to perform tasks without losing functionality, ability of the identified technology to provide accurate information, and the user rating of the overall reliability of the identified technology.

Table 24: Objective B-1.2 Data Matrix

Measure	Source	Product
Objective B-1.2: Assess Reliability		
Measure B-1-1-1: Number and type of reliability issues for the identified technology	Interview, Questionnaire Event Logs	Table, Text
Measure B-1-1-2: User rating of the accuracy of the data provided by the identified technology	Interview, Questionnaire	Table, Text
Measure B-1-1-3: User rating of the overall reliability of the identified technology	Interview, Questionnaire	Text, Bar Chart

Objective B-1.3: Assess Training
This objectives seeks to assess the effectiveness of the training provided for each of the identified technologies. Training will include classroom instruction as well as hands-on experience with the system.

Table 25: Objective B-1.3 Data Matrix

Measure	Source	Product
Objective B-1.3: Assess Training		
Measure B-1-3-1: Time required to train users	Event Log	Table
Measure B-1-3-2: User rating of classroom training	Questionnaire, Interviews	Bar Chart, Text
Measure B-1-3-3: User rating of training documents	Questionnaire, Interviews	Bar Chart, Text

Functional Area B-2: Mission Impact
Do the DAVION Applications have a positive impact on mission accomplishment?

Objective B-2.1: Assess Impact on Situational Awareness
This objectives seeks to assess the impact of the identified technologies on situational awareness. In this context a positive impact on situational awareness is defined as providing the user valuable information that will help accomplish the mission without negatively hindering that mission.
Data collectors will conduct interviews and/or surveys will be utilized to collect subjective data from users.

Table 26: Objective B-2.1 Data Matrix

Measure	Source	Product
Objective B-2.1: Assess Impact on Situational Awareness		
Measure B-1-1-1: User rating of the impact of the identified technology on improving situational awareness	Interview, Questionnaire	Table, Text, Bar Chart
Measure B-1-1-2: User rating of the impact of the overall usefulness of the identified technology	Interview, Questionnaire	Table, Text, Bar Chart

Objective B-2.2: Assess Impact on Decision Making
This objectives seeks to assess the impact of the identified technologies on decision making. In this context a positive impact on decision making is defined as providing the user valuable information that will help the user make decisions important to accomplishing the mission.

Table 27: Objective B-2.2 Data Matrix

Measure	Source	Product
Objective B-2.2: Assess Impact on Decision Making		
Measure B-2-2-1: User rating of the impact of the identified technology on improving decision making	Interview, Questionnaire	Table, Text, Bar Chart

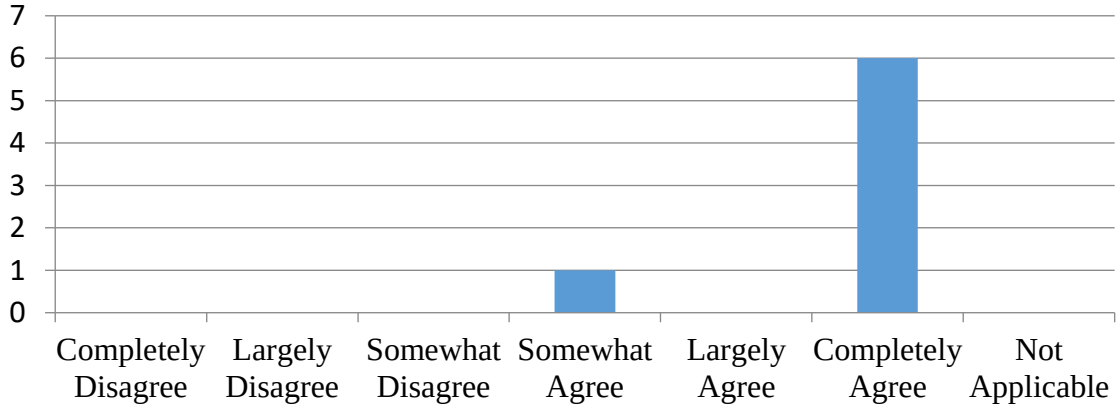
PGSS Mobile Client Survey Results

This section provides the PGSS Mobile Client survey feedback collected from participating users during the OUE 14.2 technology integration event.

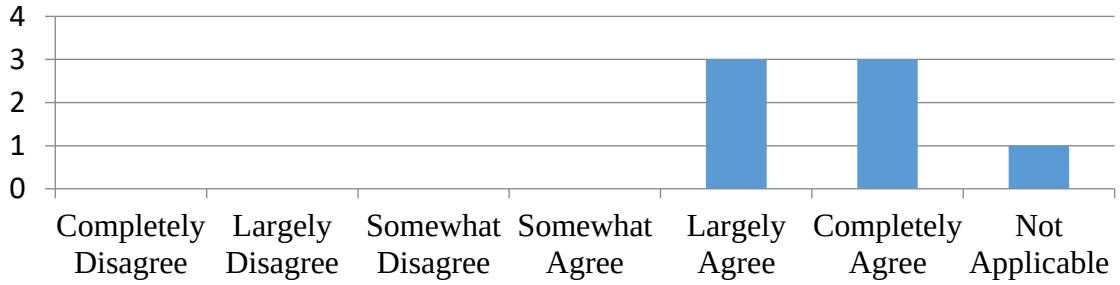
Functional Area B-1: Suitability

Measure B-1-1-1: User rating of the video quality of the identified technology

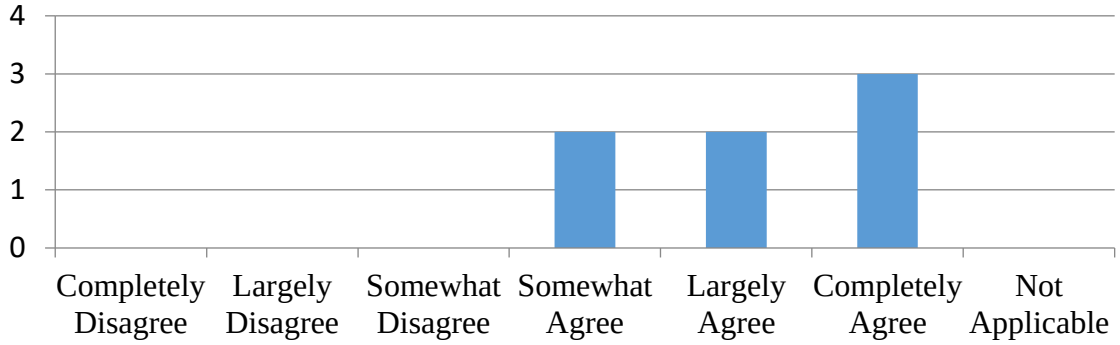
The Video quality of the PGSS Mobile Client Streaming Video capability was good.



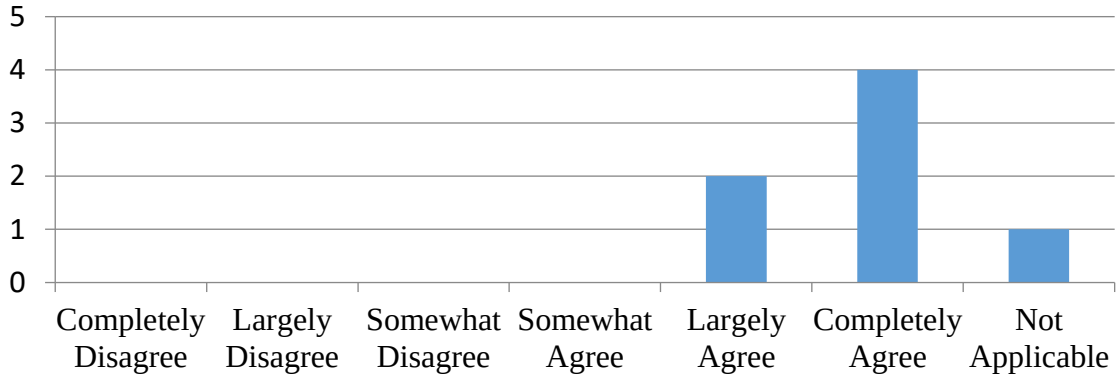
The Video quality of the PGSS Mobile Client Chat capability was good.



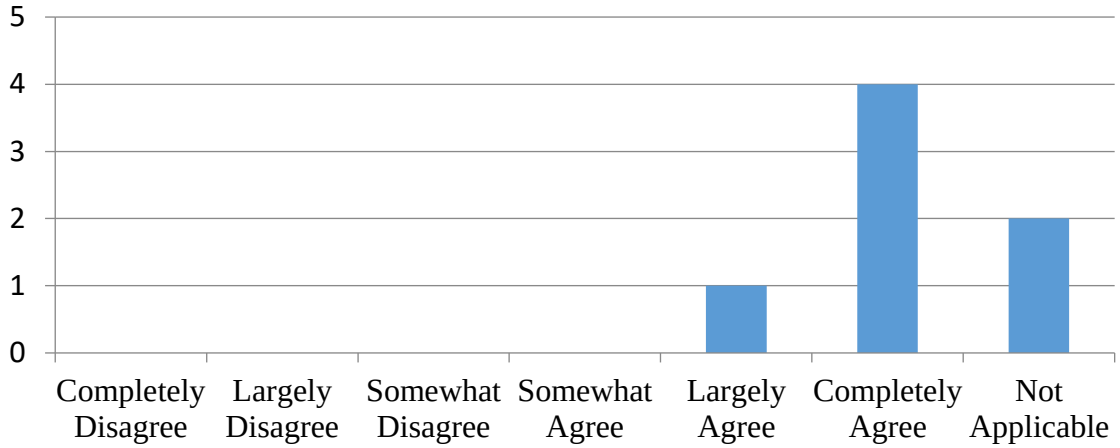
The Video quality of the PGSS Mobile Client Maps capability was good.



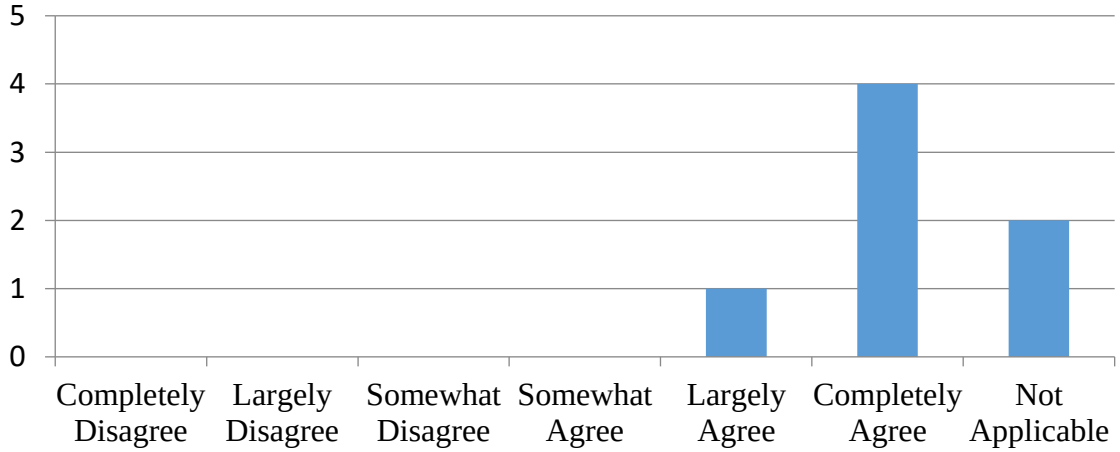
The quality of photos taken, sent, and received by the PGSS Mobile Client was good.



The quality of the telephone calls made within the PGSS Mobile Client user network was good.



The quality of the telephone calls made outside of the PGSS Mobile Client user network was good.

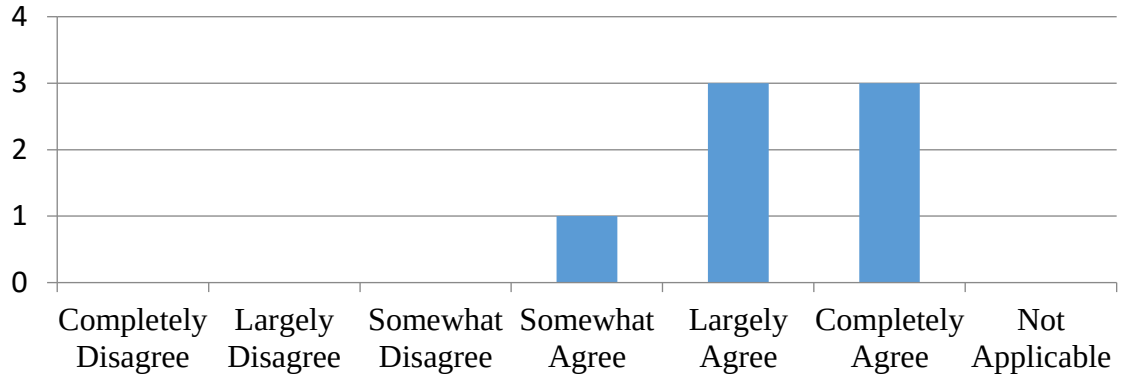


If any technologies were not ranked as Largely Agree or Completely Agree in relation to Video Quality please provide comments to clarify your ranking:

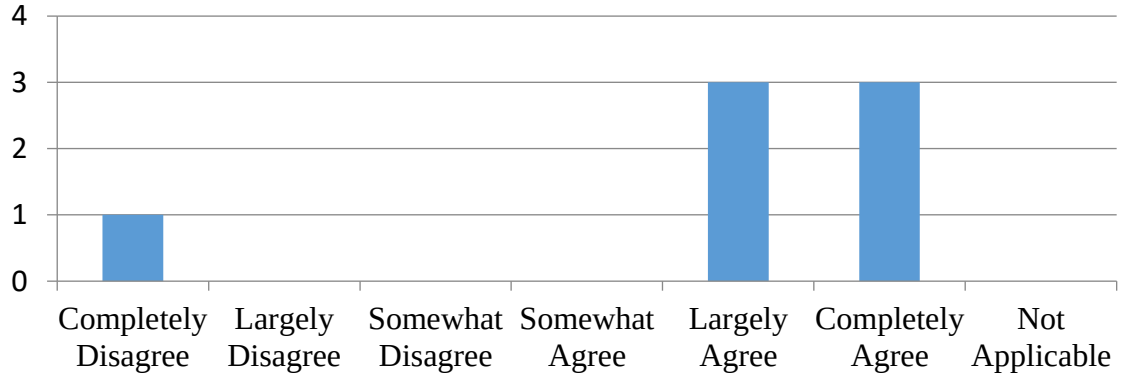
- The video quality of the map can be improved by allowing the phones to zoom in more, thus planning the pin would be more accurate and allow users to clearly see the map because every small detail in urban operations is important
- Maps seems like they were pulled from Google Maps, not updated and get blurry at points
- Pictures taken were taking a while to show up on the library so other users could not see it at the exact moment when it was taken

Measure B-1-1-2: User rating of the timeliness of data received/sent using the identified technology

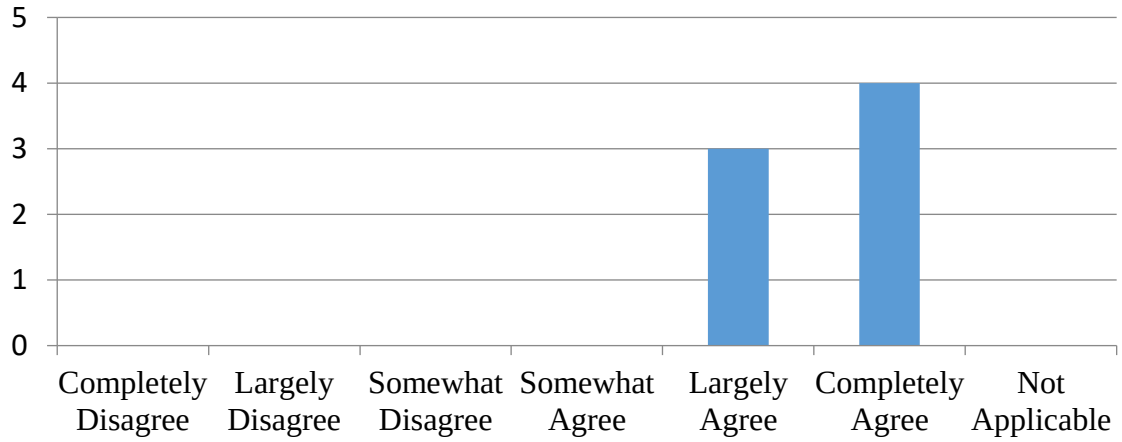
The time required to send and/or receive data using the PGSS Mobile Client GPS Tracking capability was adequate.



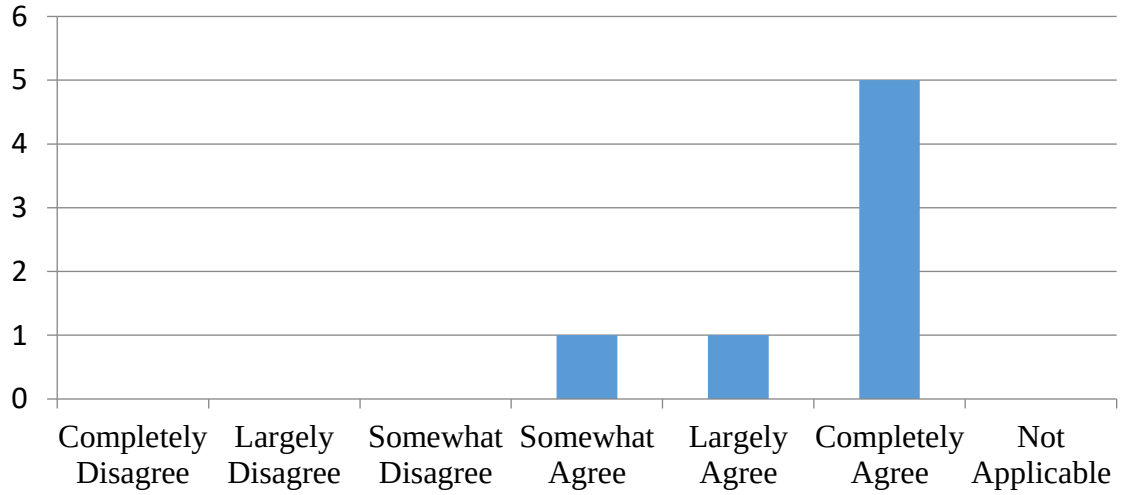
The time required to send and/or receive data using the PGSS Mobile Client Streaming Video capability was adequate.



The time required to send and/or receive data using the PGSS Mobile Client Chat capability was adequate.



The time required to send and/or receive data using the PGSS Mobile Client Maps capability was adequate.

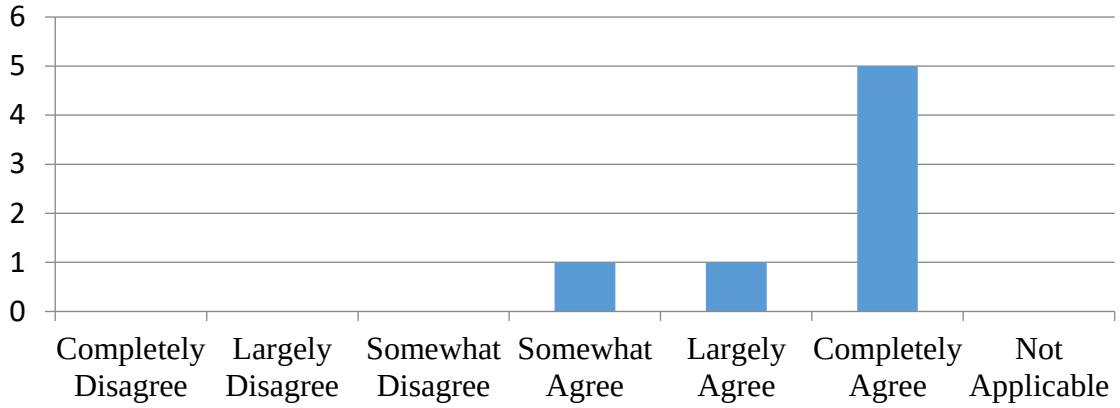


If any technologies were not ranked as Largely Agree or Completely Agree in relation to Timeliness please provide comments to clarify your ranking:

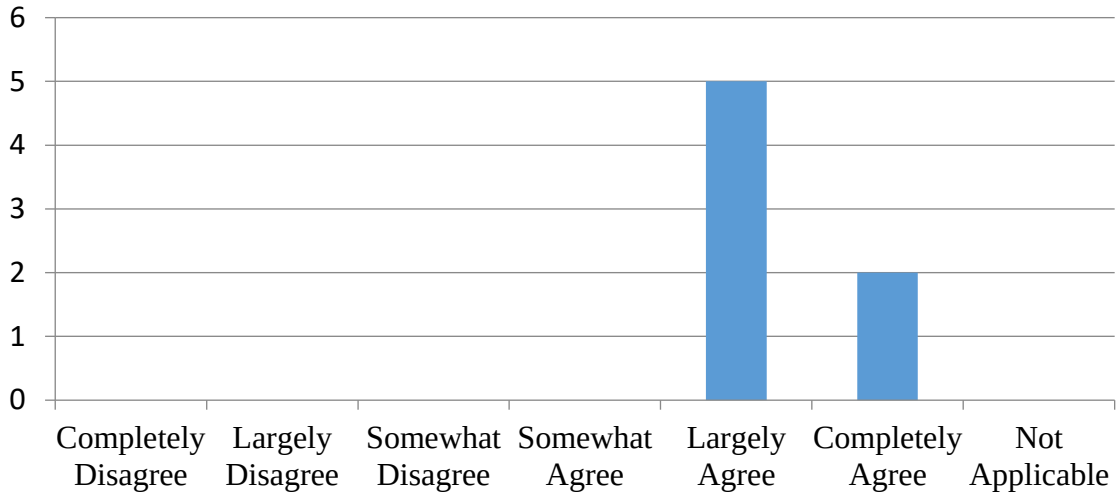
- When trying to setup POI tags or waypoints the system failed at some points
- Could have a program that tells you whether the other party has received your message so that the sender is aware. i.e. WhatsApp

Measure B-1-1-3: User rating of the overall look and feel of the user interface of the identified technology

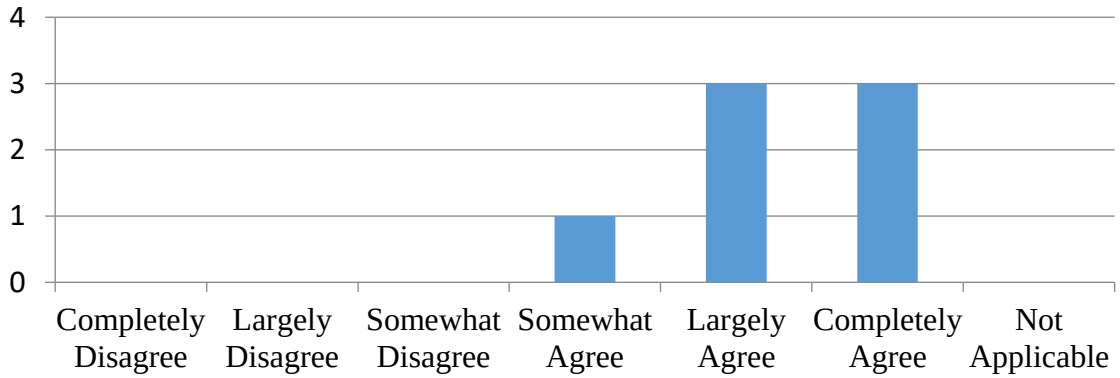
The overall Look and Feel of the PGSS Mobile Client Streaming Video capability was good.



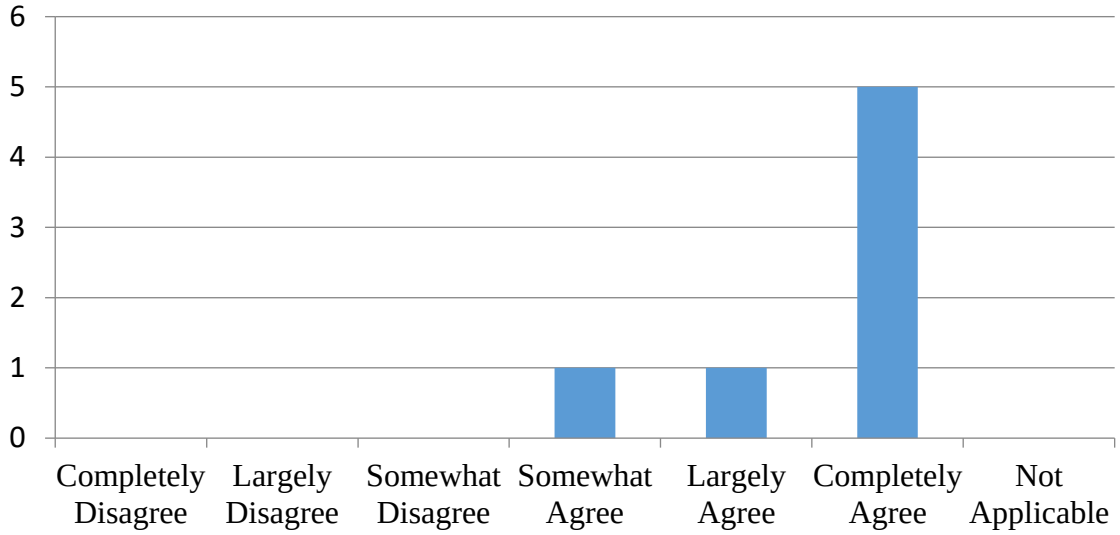
The overall Look and Feel of the PGSS Mobile Client Chat capability was good.



The overall Look and Feel of the PGSS Mobile Client Maps capability was good.



The overall Look and Feel of the PGSS Mobile Client Main Menu Interface was good.



If any technologies were not ranked as Largely Agree or Completely Agree in relation to Look and Feel please provide comments to clarify your ranking:

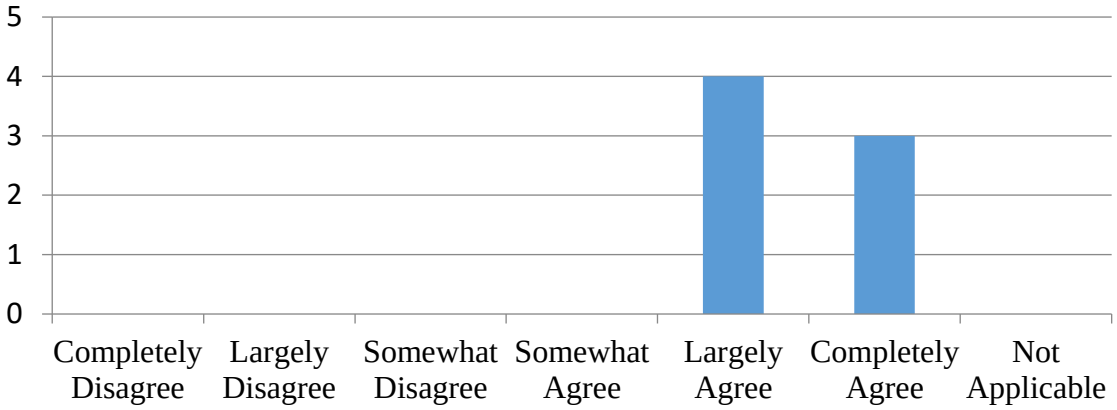
- The mobile chat could be improved by popping a small window similar to WhatsApp when you are in "video" or "map" mode. That way we know immediately there is a message received and who sent the message. This would save time because everything about urban operations happens in a split second. So a few seconds could make a lot of difference.
- Weak WiFi sometimes
- There is no need for the system to ask whether to "Chat" once the user has pressed for the other party
- The Startup/loading of the map could be faster
- The map should be integrated with the client streaming video as both have the same purpose
- Should name it surveillance/map streaming or something

Measure B-1-1-1: Number and type of reliability issues for the identified technology

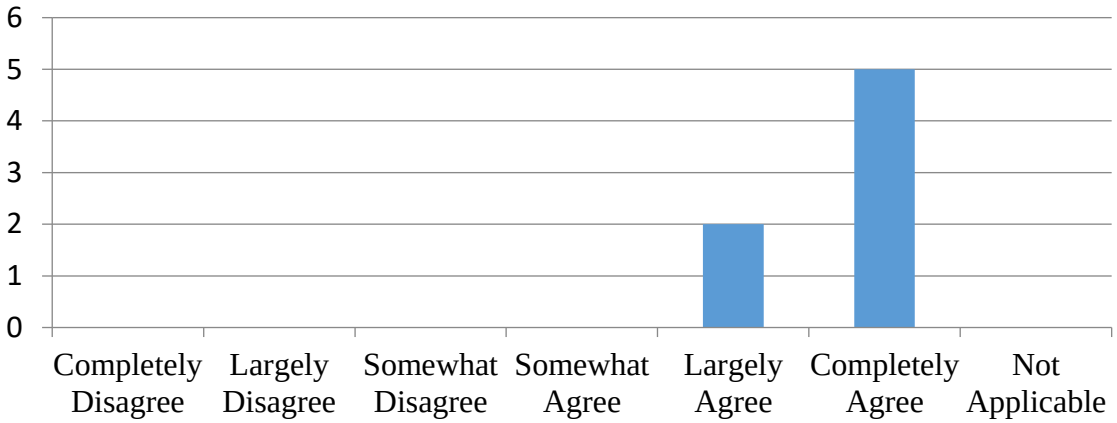
- Various reliability issues were logged during the integration of the technologies. Issues were also logged during training and vignettes. The number and type of each were not logged as the majority of issues were tied to the dropping of the Wi-Fi signal, and time with users was limited. The PGSS Mobile Client also crashed a couple of times during the event. The VA system also encountered some issues due to integration problem and a shorted timeline for training the software. Additional details can be found in the "Technology Integration" section of the report.

Measure B-1-1-2: User rating of the accuracy of the data provided by the identified technology

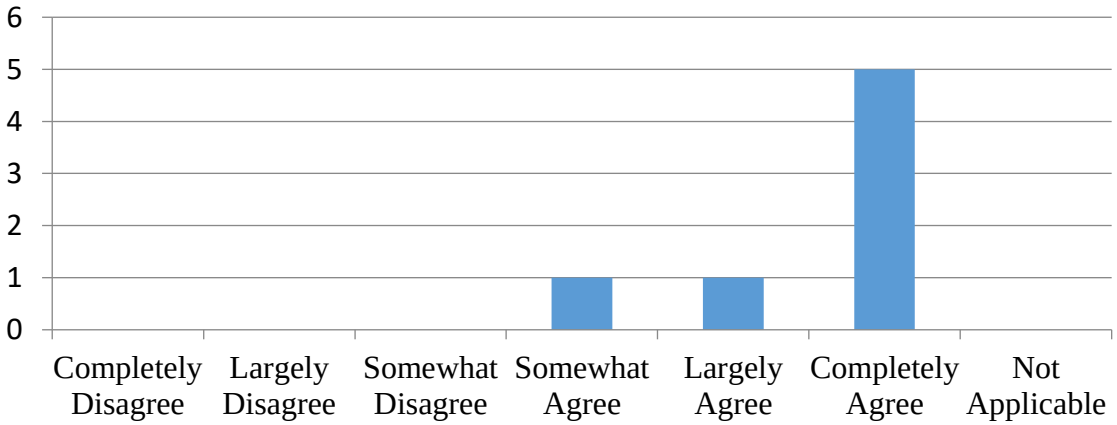
The Accuracy of the PGSS Mobile Client Map Blue Force Tracking capability data was good.



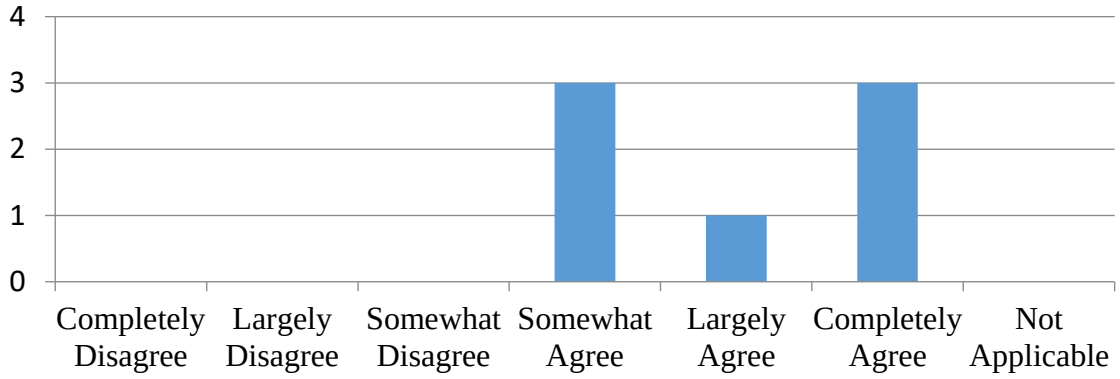
The Accuracy of the PGSS Mobile Client Streaming Video capability data was good.



The Accuracy of the PGSS Mobile Client Chat capability data was good.



The Accuracy overall PGSS Mobile Client Maps capability was data good.

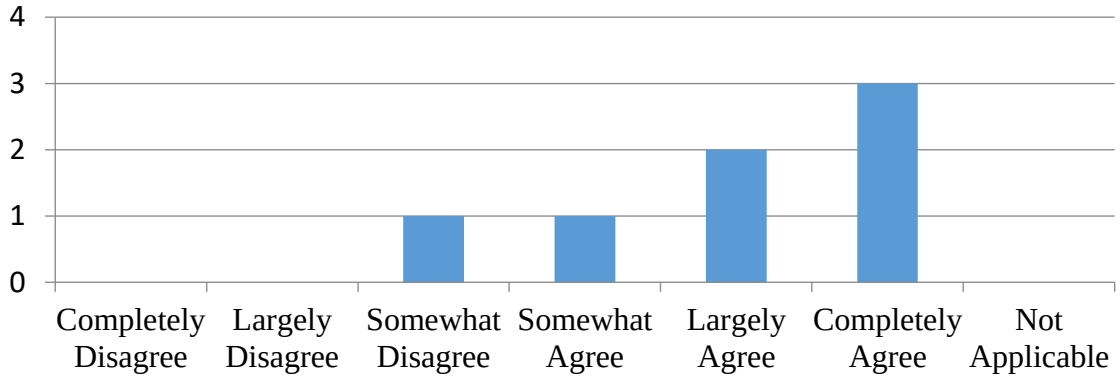


If any technologies were not ranked as Largely Agree or Completely Agree in relation to Accuracy please provide comments to clarify your ranking:

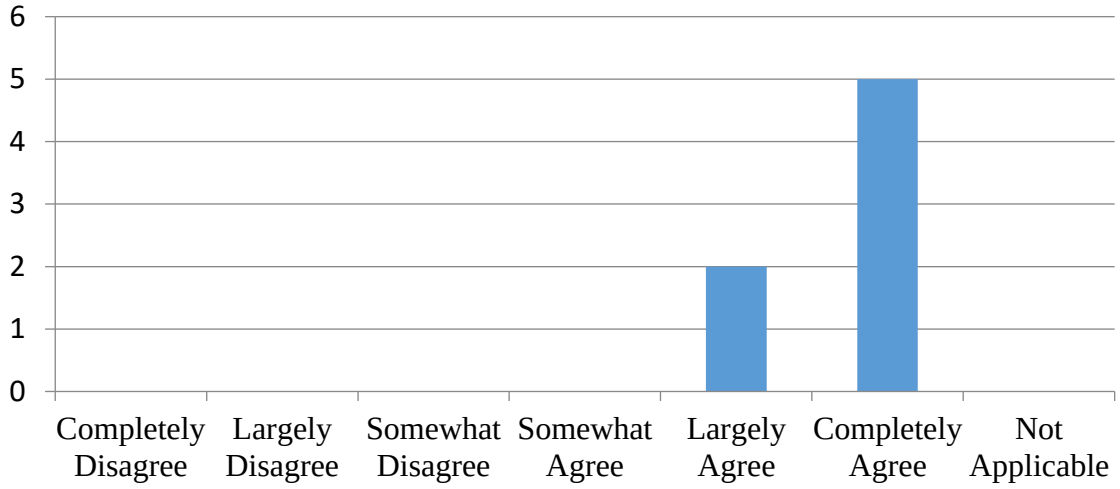
- The blue force tracking was good but sometimes needed some time to update
- Due to the limitation of zoom it's very hard to get an accurate pinpoint location
- It will be better if the streaming videos were in real time
- It would be great if the map could have options of satellite or map view like those used in Google Maps
- The user should be made aware if their message was received by the other party
- Maps could be improved by allowing more zoom to the exact detail on the ground to be accurate for pinpoint, description and photos at that pinpoint

Measure B-1-1-3: User rating of the overall reliability of the identified technology

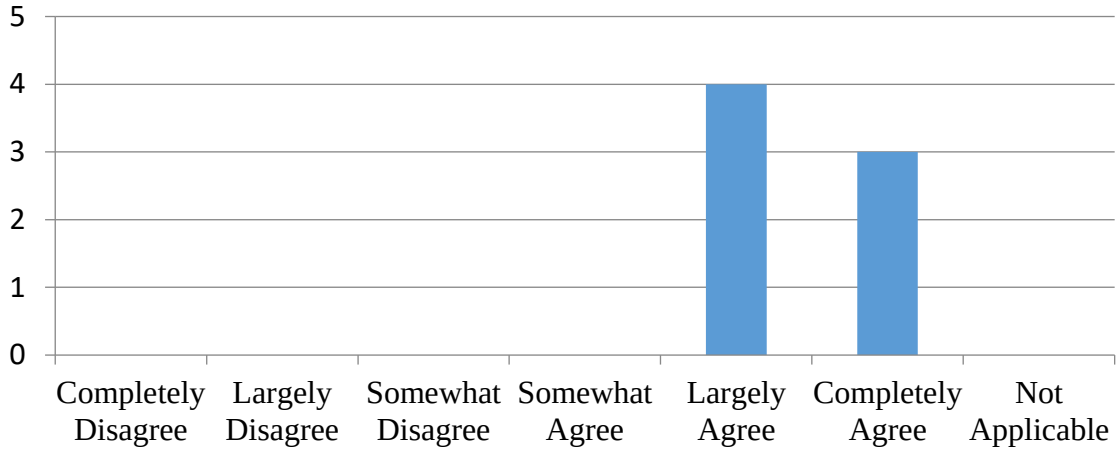
The overall Reliability (information displayed as expected and did not crash) of the PGSS Mobile Client Blue Force Tracking capability was good.



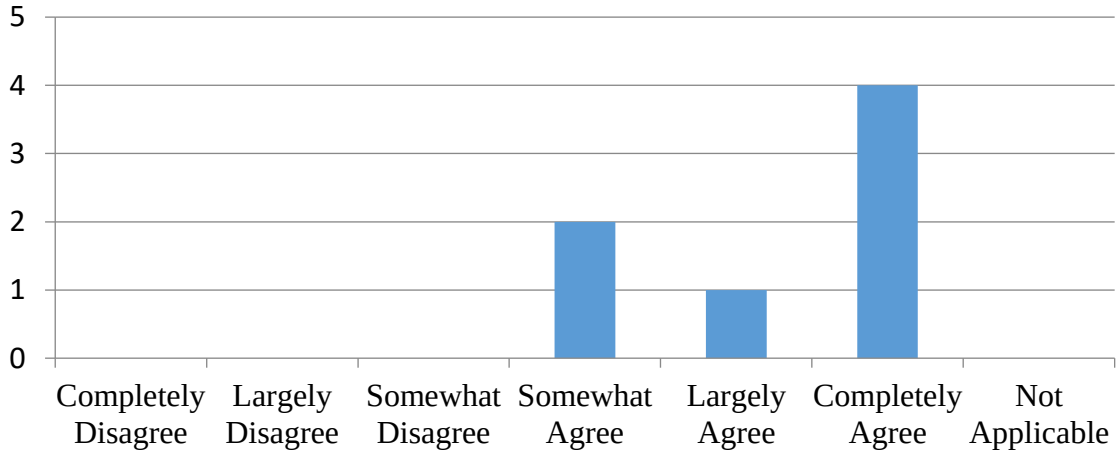
The overall Reliability of the PGSS Mobile Client Streaming Video capability was good.



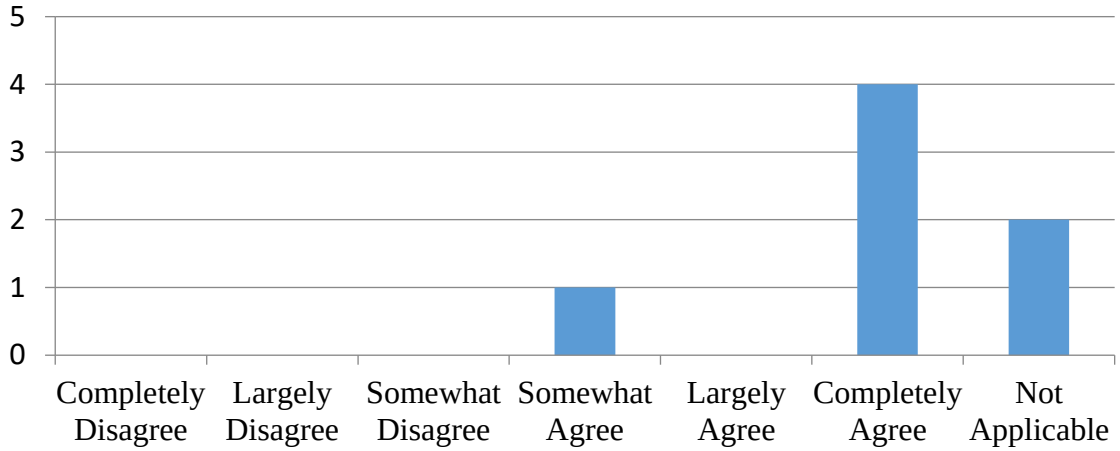
The overall Reliability of the PGSS Mobile Client Chat capability was good.



The overall Reliability of the PGSS Mobile Client Maps capability was good.



The overall Reliability of the PGSS Mobile Client telephone capability was good.



If any technologies were not ranked as Largely Agree or Completely Agree in relation to Accuracy please provide comments to clarify your ranking:

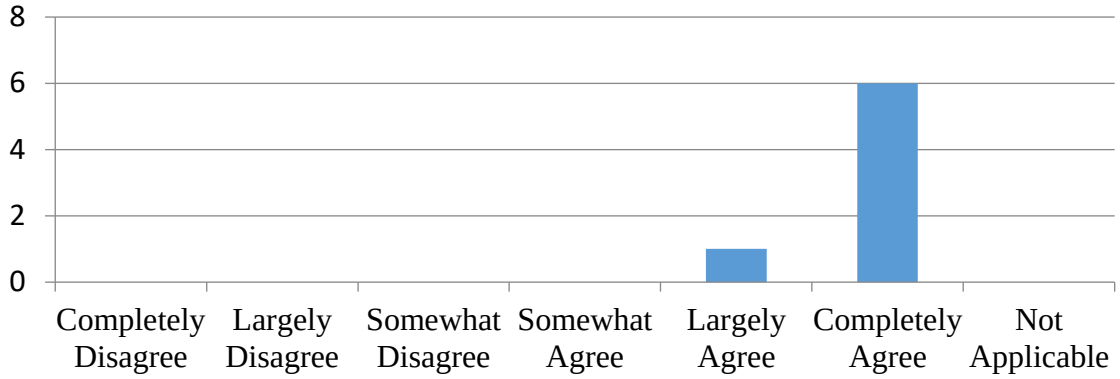
- Update the phones with more options, and compatibility with HDMI
- The program crashed a few times
- The coverage of the program at a far distance was not accurate. WiFi ability is not good when distance is more than 150m, thus not allowing for information exchange
- The telephone capability was not functioning during training
- The system crashed a few times during operations
- The client maps are a bit useless with the maps show in the client streaming video, should integrate it
- Video needed some minutes to update and connect to main or you would have to reset the app in order to see the video
- Maps can get easier to use according to the area you are operating. I didn't like that any time I got out and back in the map section it would take me all the way zoomed out and takes seconds to zoom back in on the objective

Measure B-1-3-1: Time required to train users

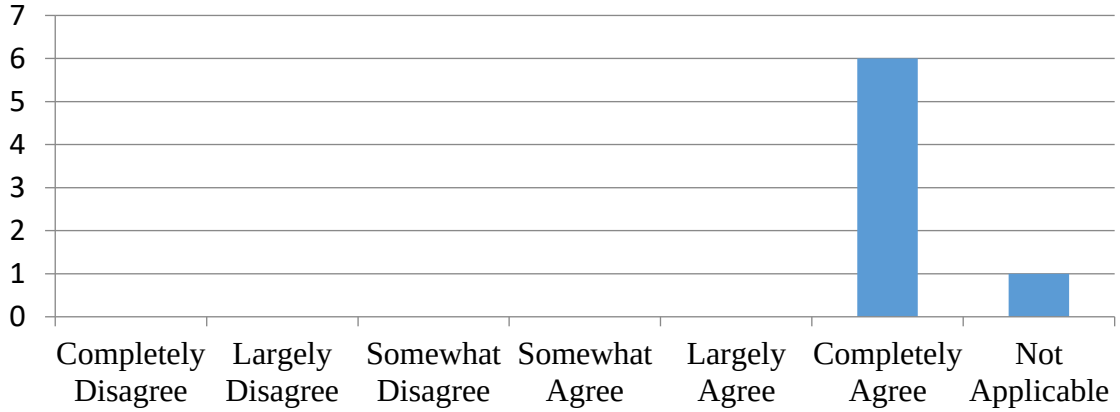
- Verbal training session was conducted in less than 1 hour. Often the users picked up on the applications within a few minutes and used the remaining time to ask questions and explore the technology.

Measure B-1-3-2: User rating of classroom and hands-on training
Measure B-1-3-4: User rating of training documents

The classroom and hands-on training provided for the PGSS Mobile Client was good.



The training documents/presentations provided for the PGSS Mobile Client applications were helpful.



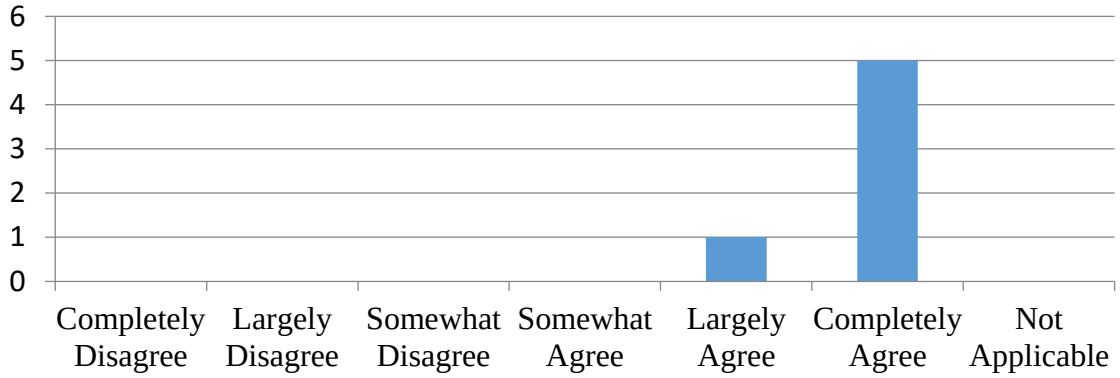
How would you suggest training be improved for any or all of the applications you used during OUE 14.2?

- I believe it's simple enough, awesome to use, and field test, easy to learn the tech as is. I jumped in late, and I was able to pick it up in 30 min
- Faster streaming, clearer picture, needs better WiFi reliability
- Notifications
- Wrist pouch
- Better WiFi
- Better screen protectors as we can't see when the sun is too bright
- Pop up of photo indicated at where we mark our waypoint
- Better zooming on blue force map so we could markout waypoints more accurately
- I thought the training was good. The system itself is pretty straight forward and easy to understand so the improvements don't need to made there
- Maybe run more scenarios but everything was good

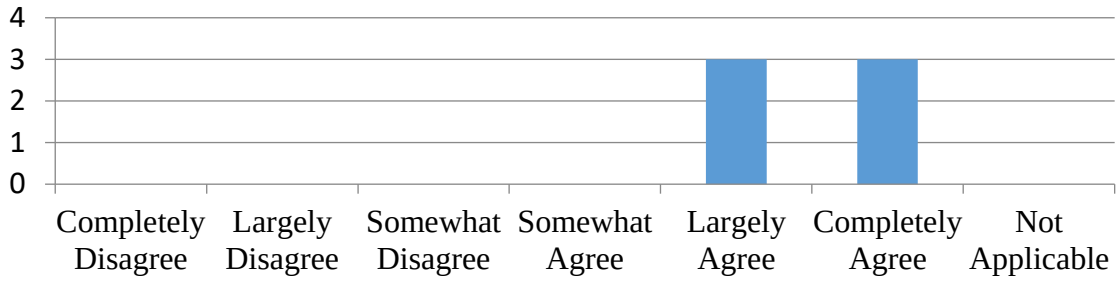
Functional Area B-2: Mission Impact

Measure B-1-1-1: User rating of the impact of the identified technology on improving situational awareness

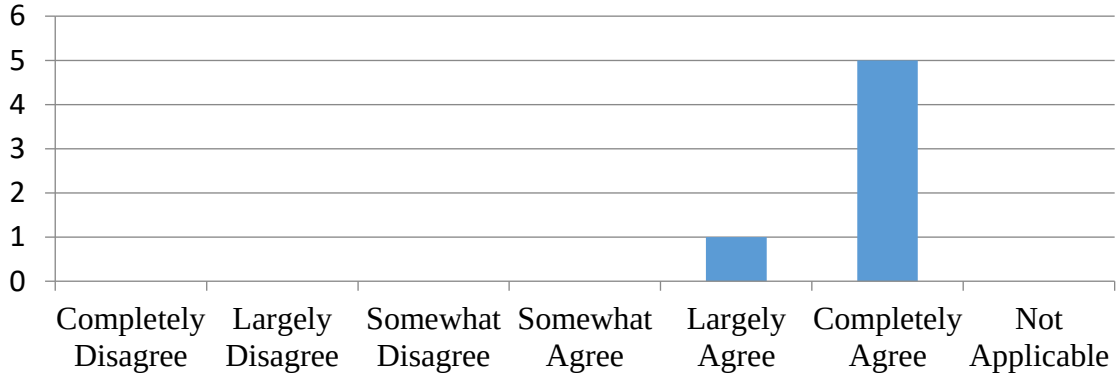
The PGSS Mobile Client Streaming Video capability had/would have a positive impact on situational awareness.



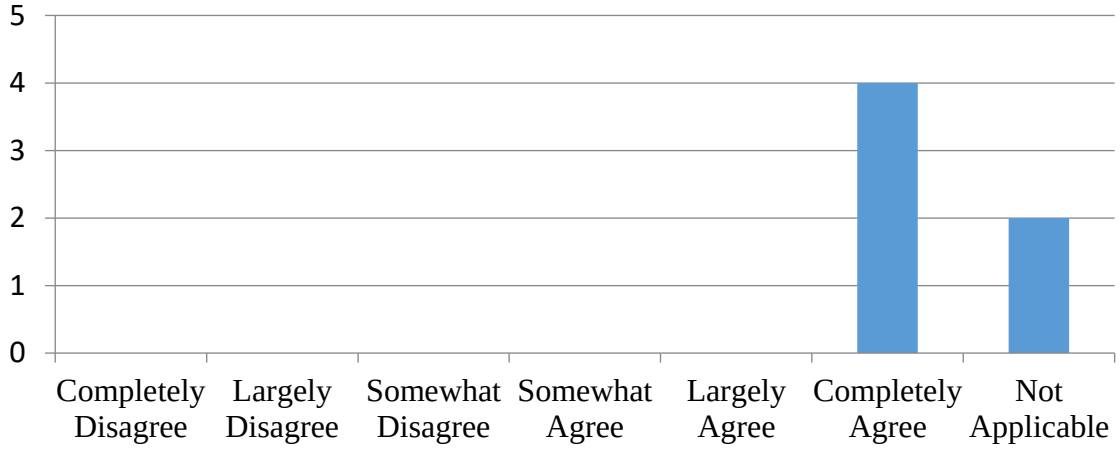
The PGSS Mobile Client Chat capability had/would have a positive impact on situational awareness.



The PGSS Mobile Client Maps capability (including Blue Force Tracking) had/would have a positive impact on situational awareness.



The PGSS Mobile Client telephone capability had/would have a positive impact on situational awareness.

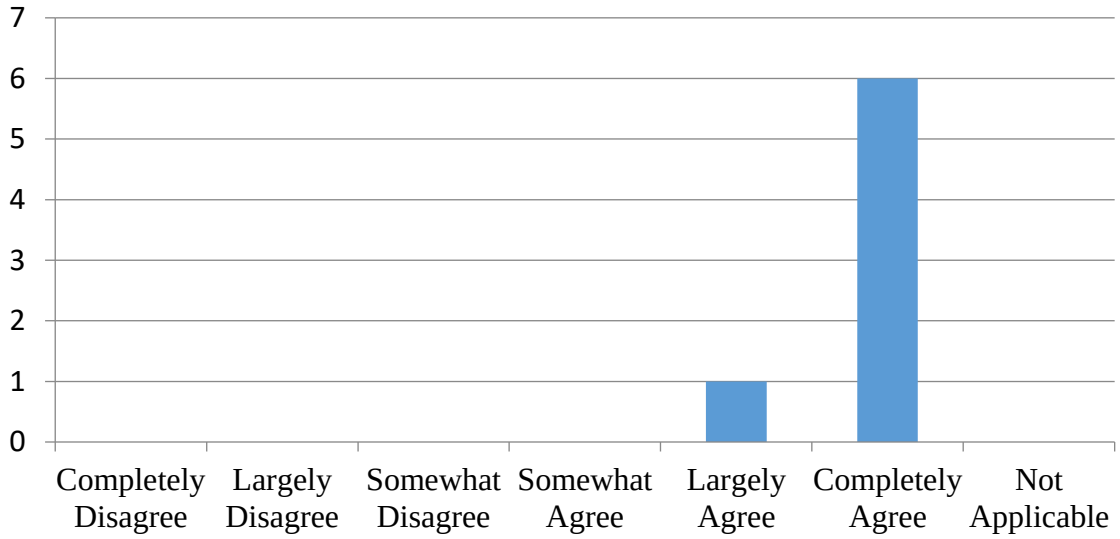


If any technologies were not ranked as Largely Agree or Completely Agree in relation to Situational Awareness please provide comments to clarify your ranking.

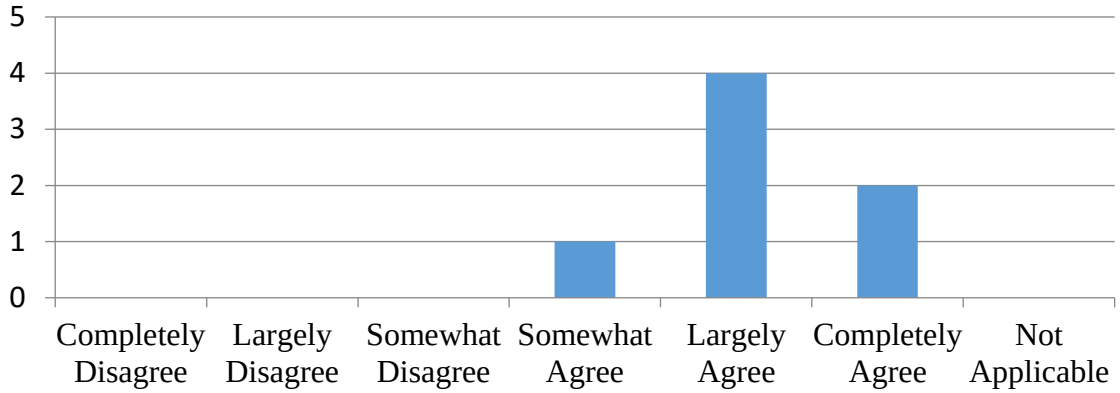
- Must have notification (vibration or ping)!
- During missions the soldier on the ground must have situational awareness and not look at the phone screen all of the time
- The telephone capability seems really helpful for faster information exchange

Measure B-1-1-2: User rating of the impact of the overall usefulness of the identified technology in urban environments

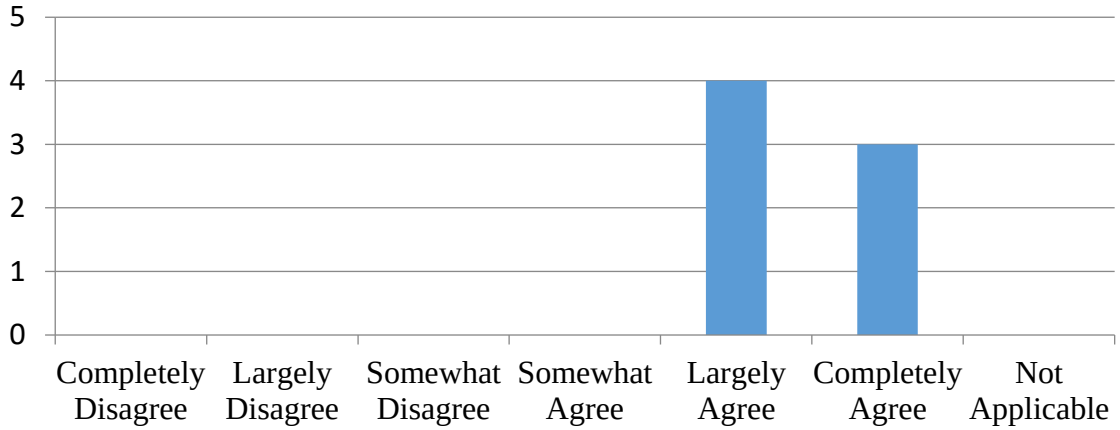
The PGSS Mobile Client Streaming Video capability would be useful in urban environments



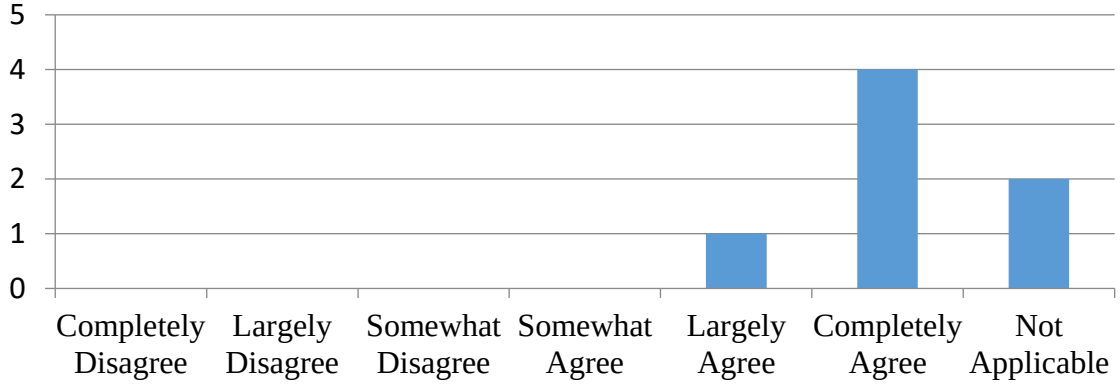
The PGSS Mobile Client Chat capability would be useful in urban environments



The PGSS Mobile Client Maps capability would be useful in urban environments



The PGSS Mobile Client telephone capability would be useful in urban environments

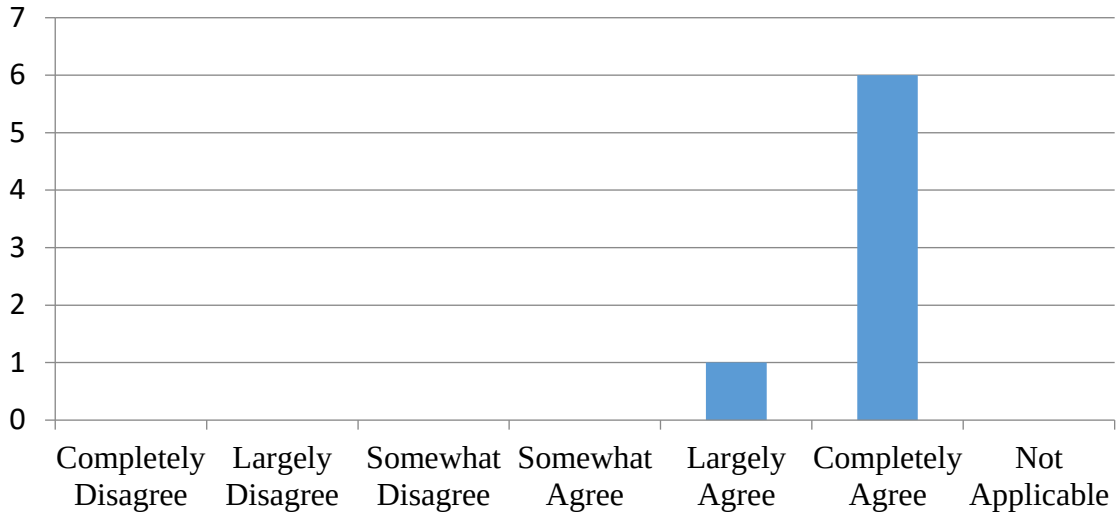


If any technologies were not ranked as Largely Agree or Completely Agree in relation to operating in urban environments please provide comments to clarify your ranking.

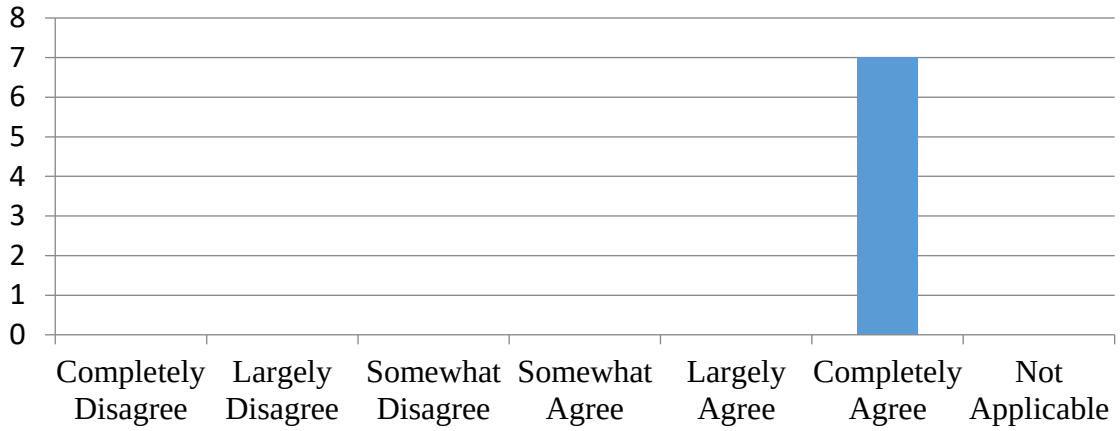
- It would be useful if it is stealth and only on deliberate attack. It wouldn't be useful if it was a hasty attack

Measure B-2-2-1: User rating of the impact of the identified technology on improving decision making

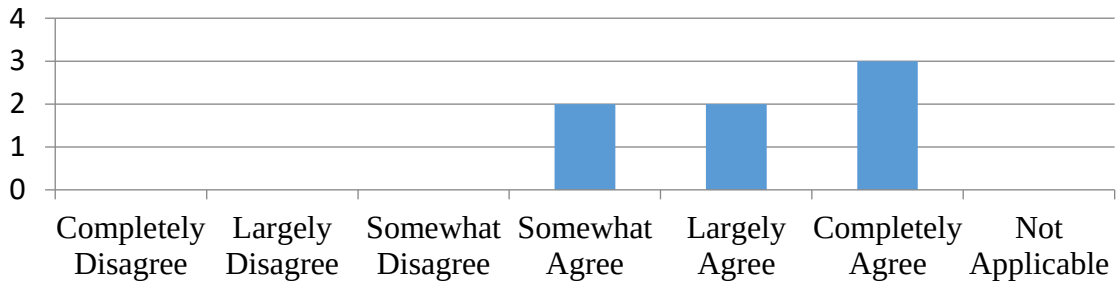
The PGSS Mobile Client Map Blue Force Tracking capability would provide valuable information to help the user make decisions important to accomplishing missions.



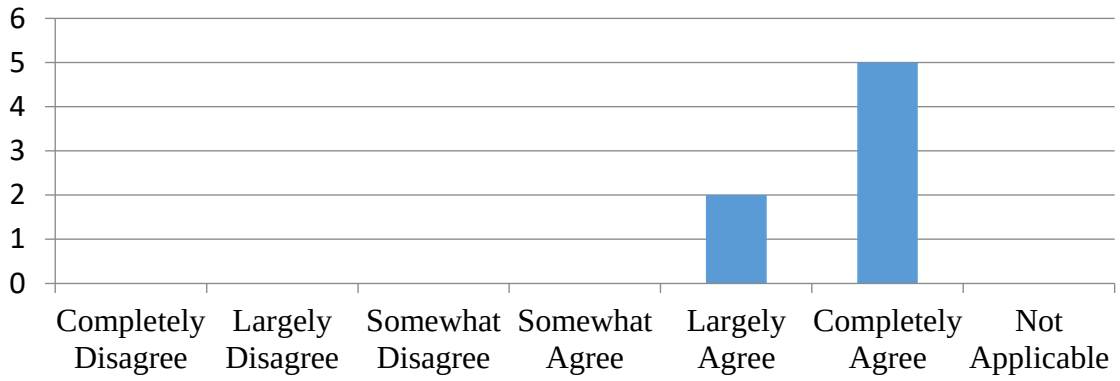
The PGSS Mobile Client Streaming Video capability would provide valuable information to help the user make decisions important to accomplishing missions.



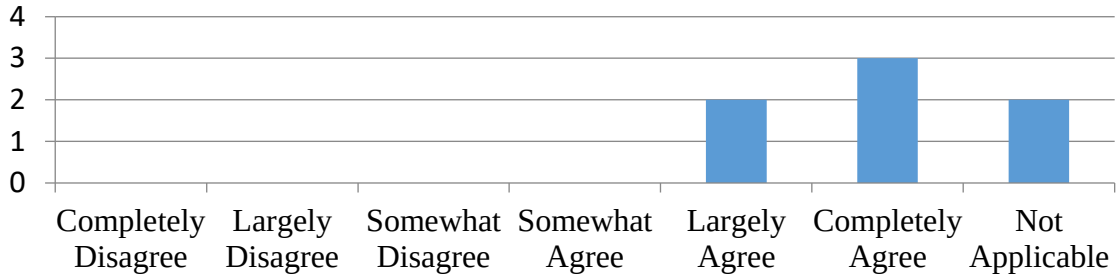
The PGSS Mobile Client Chat capability would provide valuable information to help the user make decisions important to accomplishing missions.



The PGSS Mobile Client Maps capability would provide valuable information to help the user make decisions important to accomplishing missions.



The PGSS Mobile Client telephone capability would provide valuable information to help the user make decisions important to accomplishing missions.



If any technologies were not ranked as Largely Agree or Completely Agree in relation to Decision Making please provide comments to clarify your ranking.

- The Chat function will pop up a window and ask you to press "Chat" before you can start typing a message. I think this is a double step which is kind of useless and time wasting
- I have it all at largely agree because the technology did fail us at the worst time, and possibly at the aerostat is a target for being shot down. WiFi connection wasn't that great even on peace time training.
- Chat capability is not too valuable because it is delayed and it takes longer to text than call

Additional Survey Question

Would the PGSS Mobile Client be a valuable tool in HADR environments? Explain.

- Yes, to see a bigger area with live streaming to see what going on, and also to pinpoint specific personnel/items
- Yes definitely; It allows blue force tracking, The pinpoints on the map would be very useful to show all important locations be it blue or red force, it allows fast information exchange through troops on the ground and higher HQ, and allows higher HQ to have a clear view of what is happening on the ground
- Yes it will, as HADR is more central environment, we could use it to scan the area to check for suspicious suicide bombers

- Yes, you could see how many people may ned to be rescued or how flooded an area is before you go there or just what the overall situation is like
- Yes, we would have an aerial view of operations. Assistance could be given a priority to those in areas needing it most
- We could also be updated if there were to be any riots that have been formed up during the HADR mission, e.g. when NGOs are handing out food rations/medical
- Yes, it would be, you can deploy the PGSS and get a live video stream of what the situation looks like, search for survivors, and be able to deploy units and maintain visual and chat capabilities with them at all times.

Are there any other environments where any or all of the PGSS Mobile Client applications would be valuable?

- Combat, HA, Border security, police department
- Conventional
- Desert, grasslands
- Company operations base, platoon operations base, VIP escorts
- Conventional operations, the blue force tracking would be good because it is always hard to locate your blue forces
- Conventional operations, the chat would be good for information exchange while still adhering to field noise discipline
- Jungle, desert, mountains
- At sea, maybe having that tech attached to scout helos and over watch helos to give a team more of a head count on enemy combatants before conducting a UBSS mission

Are there any changes you would make to any of the PGSS Mobile applications?

- Better WiFi and faster, clearer streaming
- See comments in previous questions
- The interface

Are there any additional applications that would add value to the PGSS Mobile applications package?

- Different types of users in order to classify different phones in different categories so the squad leader can have more control, able to zoom in/out, text to main, where other users only have the ability to watch and text, making it easier to have one guy control
- Marking of red force danger areas
- Emergency buttons
- Reset buttons for all classified info in phones
- Larger coverage area
- In Chat if you click a user it transitions to chat instead of having to click the chat button
- Voice clip
- Video capture
- Better phone so you wouldn't have to get so close to potential threats
- Video calls
- Emergency buttons like total erase, contacted, need reinforcements, etc.
- See comments in previous questions

Summary

The purpose of the OUECF is to explore and demonstrate technologies and capabilities for urban operations in the context of operationally relevant scenarios. As part of the that framework, OUE 14.2 was conducted in Piedra del Lumbre (PDL) Combat Town, Camp Pendleton, CA from 5-19 December 2014 in conjunction with Exercise Valiant Mark 14.2. The event consisted of an integrated demonstration of the Persistent Ground Surveillance System (PGSS), 4G LTE communications, video analytics, and the DAVION and PGSS Mobile smart phone applications. Technologist from various Singaporean and U.S. organizations, and users from the Singaporean Guard and Alpha Company, 1st Battalion, 5th Marine Regiment participated in the event.

The participating technologists, Singaporean Guard users, and U.S. Marine users all provided feedback on the technologies that were inserted in OUE 14.2. Overall, the technologist viewed the integration of the technologies as a valuable and engaging, collaborative experience. Survey data reflected a very positive outcome, with most users viewing all aspects of the integration process as a success. The technologist provided valuable feedback on how to improve future integration events, with the emphasis being on additional integration time, and the participation of key technologist for the duration of the event. The Singaporean Guards and U.S. Marines provided the technologists with valued feedback on the functionality, possible improvements, and streamlining of the capabilities of the DAVION applications and PGSS Mobile Client. The survey data reflected that in almost all cases the users were very happy with the technologies and felt each would be a valuable asset for decision making and situational awareness in almost any environment.

A combined team of Singaporean Guards and U.S. Marines, using the DAVION and PGSS handsets, successfully conducted a live demonstration of some of the features provided by the applications, while utilizing the PGSS network and Video Analytics software on December 19, as part of the DV Day. Visitors were also provided technology briefs and encouraged to ask questions and provide feedback on the application of each technology. The event was attended by over 60 guests including; Major General Lawrence D. Nicholson, Commanding General, 1st Marine Division, COL Lim Siong Tiong, Head Concept Generation Group, Future Systems and Technology Directorate, COL Tan Cheng Kwee, Commander 7 Singapore Infantry Brigade (7 SIB), Sergeant Major David L. Jobe, Sergeant Major, 1st Marine Division, and other military and civilian visitors of note.

Overall, OUE 14.2 was a successful event for technology insertion, integration, data collection, and partner nation S&T collaboration efforts. The data collected from this event will help shape continued technology development for our warfighters and future PACOM S&T engagement effort.

APPENDIX A: OUE 14.2 DOCUMENTATION

- OUE 14.2 documents including; surveys, demographics forms, event logs, and brochures can be provided upon request. Please note that the surveys, demographics, and event log forms are blank forms to protect the anonymity of the users and participants.